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DEATH OF SIR CLEMENTS MARKHAM.

THE Fellows of the Society will receive with deep regret the announcement of the death of Sir Clements R. Markham, K.C.B., F.R.S., on 30 January 1916, in his 86th year. His death was the result of shock caused by burns from a fire in his bedroom on the previous day.

MINUTE OF COUNCIL 7 FEBRUARY 1916.

"The Council desire to place on record their profound sense of the loss which the Society and Geography have sustained by the death of Sir Clements Markham.

"Sir Clements Markham had been intimately connected with the Society for over sixty years, during the greater part of which he was officially associated with its affairs. From the years 1863 to 1888, that is for a quarter of a century, he was serving as one of its Honorary Secretaries. For twelve years, from 1893 to 1905, the longest period on record, he held the office of President. During all this time he was indefatigable in the promotion of the objects for which the Society exists. He took a prominent part in all the developments of its work, scientific and educational. By his sympathy and keen interest he did much to further exploration in all parts of the world. The recent renewal of Antarctic exploration on a large scale was mainly due to his initiative, enthusiasm, and energy. By his sympathetic attitude towards all the members of the Staff he secured devoted loyalty not only to himself but to the best interests of the Society. His death will be felt as a personal loss by geographers all the world over.

"The Council desire to assure Lady Markham and the family of their deep sympathy in the loss which they have sustained."

The following tribute to the memory of Sir Clements Markham was paid by the President, Mr. Douglas W. Freshfield, at the Meeting of the Society on February 7:

It would be, I am sure, contrary to your feelings were I to proceed to the ordinary business of this evening without any reference to the loss the Society has suffered since we last met by the death of Sir Clements Markham, a loss which breaks many links with the past. Sir Clements Markham joined the Society in 1853, 63 years ago. He became one of your Honorary Secretaries in 1863; he held that office for 25 years until 1888. In 1893 he was elected President, and in that capacity ruled the Society for 12 years, a longer term of continuous office than had fallen to any of his predecessors in this chair.

Were I to attempt to recount in any detail the amount of geographical and literary work done by Sir Clements in his long, varied and strenuous career I should occupy the whole evening. That may be done elsewhere. To-night I can only indicate a few of its leading features.

Entering the navy at 14 he left it at 22, after having taken part in a Franklin Search expedition. This early experience, at once recorded in his first book, largely directed his energy as a lifelong and ardent instigator of Polar enterprise.

For the moment, however, with characteristic versatility, he turned his attention to Peru, and his journey there and the volume that recorded it led to his being subsequently employed by the India Office, into whose service he had entered, to transplant to India the cinchona plant, a work which must in itself entitle Markham to perpetual remembrance as a benefactor to mankind.

His official connection with the India Office drew his attention to another of the countries which became his special study, Tibet. He also followed with a very special interest the progress of the great Survey of India.

But in the quarter of a century during which he was one of our Honorary Secretaries, and for the succeeding twenty years, during which he was mostly either on the Council or acting as President, his main sphere of activity was in the affairs of our Society. During a part of this time, some seven years, I served with him as an Honorary Secretary, and I can speak therefore with personal and intimate knowledge of some of the work he accomplished.

When Markham first joined the Society, its fortunes, though not at their lowest ebb, were only slowly recovering from a time of great depression. Its Fellows hardly numbered 1000: they are now over 5000. The man who mainly restored its fortune was, needless to say, Sir Roderick Murchison.

In 1871 Murchison passed away, and for many years the Presidency was held by men of high distinction in public life, but most of them with

separate interests and not all of them geographical experts. Consequently the impulses which directed the actions of the Society came largely from the Honorary Secretaries and their most able coadjutor the Assistant Secretary, Mr. Bates. Like most large committees our Council was apt to be conservative and somewhat suspicious of novel proposals. It did its work handsomely in encouraging and speeding departing explorers and in welcoming them on their return. After Sir Roderick's time and Livingstone, there came to us many other great Africans, Burton, Speke, Grant, Galton, Baker and Stanley, Thomson and Selous. It was the era of the Dark Continent's discovery. But in more domestic work there was a need for active initiative, and to this Markham largely contributed.

One of his chief and most fruitful successes was the foundation of the monthly *Proceedings*, which was the forerunner of the *Geographical Journal*. England had at that time no geographical magazine that could compare with the German *Petermanns*. Efforts to found one independently were made by Bates and Markham, but the public did not respond. Some members of our Council were afraid both of the expense and (oddly enough, one sees now) of some injury to the dignity of the Society by its issuing a monthly magazine. The thin end of the wedge was got in when a sanction was obtained to the issue of *Proceedings*. These under the admirable editorship first of Bates and afterwards of Dr. Keltie, developed by successive steps into the present *Journal*, the first geographical periodical of the world, a publication which has rejoiced our Fellows and carried the fame of the Society over the four continents.

In promoting education also Markham was energetic. His own special interests were the Training Ships *Worcester* and *Conway* for educating boys for the Navy and Mercantile Marine, and the Scientific Education in Surveying for Intending Travellers, which, under Mr. Coles and Mr. Reeves, has developed into a system of the greatest service to the National Services, to young officers and future colonial administrators. On the wider proposals for insisting on the place of Geography in National Education and backing the Society's endeavour by grants towards the maintenance of Schools of Geography at Oxford and Cambridge, Markham looked at first with some hesitation. But I remember with pleasure that it was partly through my persuasion that he overcame any doubts; and the scheme once launched, he joined with all his customary energy in its furtherance—in fact, he adopted it as his own.

There were many minor improvements effected under his auspices as Secretary. I may mention the use of lantern-slides at our lectures. I betray, perhaps, a secret when I tell you that the first time they were used the Honorary Secretaries did not dare to consult the Council beforehand for fear the suggestion should be condemned as beneath the reputation of the Society. The Meeting, however, greeted the innovation with so much applause that no question was raised and the practice has become permanent.

In 1893, after the passing storm which for a time postponed the admission of Lady Fellows into the Society, the Council turned to their former Honorary Secretary to compose the troubled waters as President.

As a Secretary Markham had been a moving spirit, as President he became a controlling power. For twelve years—years of great prosperity to the Society—he directed its affairs with a strenuous hand. An innovator, when his enthusiasm was aroused, he was also a strong upholder, almost a worshipper of our rules and traditions. The outstanding feature of his long Presidency was the revival of Antarctic Exploration. For this object no discouragement could thwart his combative energy; for years he wrestled with indifferent Chancellors of the Exchequer until he finally got his grant, or argued forcibly with fellow men of science in support of his own views on the aims and organization of the expeditions. Even if there was at times some resultant friction there was constant movement and a successful result.

To Captain Scott Markham had a personal devotion, and the first success and subsequent disaster of the gallant explorer were perhaps the greatest joy and distress of his life.

Of Markham's literary career one of the main features was his connection with the Hakluyt Society, of which he was for long President. As a writer his industry, his facility, and his versatility were alike remarkable. The two latter qualities were indeed so pronounced as to be in a sense defects which impaired the quality of some of his work. He was the author of perhaps half a hundred volumes and tracts dealing not only with Geography, but with History, Biography, and other subjects.

Markham was a man whose only idea of recreation was a fresh piece of work. When he came back from Mont Estoril, in Portugal, last spring at the age of eighty-five, he brought back for the Hakluyt Society the material for fresh volumes. Under a quick and abrupt manner he concealed a warm and kind heart. To our staff he showed a sympathy which encouraged every man to do his duty, and inspired a warm personal feeling towards himself. In losing Sir Clements Markham by a most unkind if not untimely fate, we lose not only the Fellow who had probably been longest on our list, but a geographer of the widest interests and knowledge, and a colleague who had for half a century worked harder than any man living for the interests of the science he followed, and the Society to which he was heart and soul devoted. He will be missed not only among his own colleagues but by geographers all the world over. The Nestor of Geography, we may say of him that he lived through two generations of men and ruled among the third.

BIOGRAPHICAL SKETCH.

Dr. J. Scott Keltie, late Secretary of the Society.

By the death of Sir Clements Markham on 30 January 1916 the Society has lost a Fellow of over sixty years' standing, and one who, for the greater part of the last half-century, had been one of its most eminent and devoted officers. He was everywhere recognized as the leading representative of British Geography. His Fellowship goes back to a period when several of the more distinguished founders of the Society were still alive and active. When he joined the Society in 1853, the Earl of Ellesmere was President, and he was associated during his Fellowship and his long-continued honorary secretaryship with such men as Sir Roderick Murchison, Admiral Beechey, Earl de Grey, Lord Ashburton, Sir Henry Rawlinson, Sir Bartle Frere, Sir Rutherford Alcock, Lord Dufferin, Lord Northbrook, Lord Aberdare, and Sir Richard Strachey. He long survived all those with whom he was so intimately associated. To his many later friends all over the world his death will be regarded as a personal loss.

Clements Robert Markham was born at Stillingfleet, in Yorkshire, on 20 July 1830, the year in which the Society was founded. He was the son of the Rev. D. F. Markham, vicar of Stillingfleet and Canon of Windsor, and of Catherine, daughter of Sir William Mordaunt Milner, Bart., of Nunappleton. The great-grandfather of Sir Clements was Archbishop of York, and on both his father's and his mother's side he was connected with some of the oldest families in England; he could trace his ancestry back to a very remote period. One of his favourite hobbies was genealogy and heraldry, and with his wonderful memory he could tell at once of the relationships of almost every one of our historic families.

Sir Clements was educated at Cheam and at Westminster School. To the latter he remained strongly attached to the end of his life, in late years being one of its governors, and a trustee of Dr. Busby's charities. The Markhams had been more or less of a naval family for generations, and young Markham entered the service in 1844 at the age of fourteen, and retired in 1852. During the period of his service as naval officer he had some exciting experiences in hunting Riff pirates in the Mediterranean. Comparatively short as his period of service in the Navy really was, it made a deep and lasting impression upon him; throughout his life he was ever ready to help and befriend young naval officers. He was so convinced of the utility of naval discipline that for the Polar expeditions in which he was deeply interested he always endeavoured to procure the services of naval officers and men. Before he retired from the Navy he had his first experience of exploring work as a member of the Franklin Search Expedition of 1850–51 under Captain Austin. He was then a midshipman, and sailed in the *Assistance*, under the command

of Captain Ommanney, with Leopold McClintock, Sherard Osborn, and Vesey Hamilton as fellow-officers. He was the last survivor of all the members of the expedition, officers and men. A few months after his return from the Arctic young Markham, then only twenty-two years of age, published the story of his experiences under the title of 'Franklin's Footsteps.'

In the year in which Markham retired from the navy, 1852, he visited Peru, mainly to inquire into the remains of the Inca period. He spent two years exploring the country and investigating its remains, the result being a volume entitled 'Cuzco and Lima,' published in 1856, which threw considerable light upon a perplexing problem. Sir Clements maintained a keen interest in Peru, and indeed, in South American exploration and ethnology, up to the end of his life, and as recently as 1910 published a volume on 'The Incas of Peru.' The knowledge of Peru thus acquired by Markham was, a few years later, utilized in what has proved a priceless service to humanity. In 1859 he was entrusted by the Secretary of State for India with the superintendence of the necessary arrangements for the collection of the cinchona plant, and for its introduction into India. With this object he again visited South America in 1860, accompanied by a collector and three other companions, and with complete success arranged for the transmission of the invaluable plant to India. In carrying out this great undertaking Sir Clements and his companions had many adventures and ran some risks while penetrating into remote parts of Peru, which had probably never been visited by Europeans before. Thus the cinchona plant was introduced into India and cultivated there so successfully that the price was reduced from something like 20*s*. to a few pence an ounce. Sir Clements himself went to India to superintend the introduction of the plant, and the result was another interesting volume, covering a much wider field than the collection of cinchona, 'Travels in Peru and India, 1862.' Three years later he again visited India as well as Ceylon, to report on the Pearl Fisheries. Besides the works already mentioned, his continued interest in Peru was manifested by various publications in later years, such as his 'Quichua Grammar and Dictionary,' 1865 and 1908, 'Ollanta, a Quichua Drama,' 1871, 'Peruvian Bark,' 1880, and 'The War between Chili and Peru,' 1879–81. Moreover, it was through his initiation that the Society in 1910 published the first sheet, embracing part of Peru and Bolivia, of a new map of South America which, it is hoped, may be completed when more prosperous times arrive.

The next important enterprise of Sir Clements was the part which he took in the Abyssinian War of 1868 as the geographer to the expedition. He was present at the storm and capture of Magdala, and it was he who discovered the body of King Theodore. On his return he published a history of the Abyssinian Expedition. It was on this expedition that he first met the late Sir Henry Stanley, who accompanied it as correspondent

for the *New York Herald*. Sir Clements had some interesting reminiscences of Stanley, who was then quite unknown.

At the date of the Abyssinian expedition Sir Clements had been Honorary Secretary of the Society for five years, having been elected in 1863. This position he held for a quarter of a century, retiring from it in 1888, when the Society awarded him the Founder's Medal. It was a stirring period in the history of the Society and in the history of Geography. A year after Markham became Honorary Secretary, the position of Assistant Secretary became vacant, and no doubt it was greatly through his influence that the services of the distinguished South American explorer and naturalist, Mr. H. W. Bates, were secured for that post. They became fast friends, and the two worked together devotedly for the interests of the Society, even after Markham's retirement from the post of Honorary Secretary in 1888. It was during the period of his secretaryship that the exploration of the great blank in the centre of Africa was being carried out with ever-increasing vigour. Markham thus became intimately associated with the work of Livingstone, Burton, Speke, Grant, Cameron, Baker, Thomson, Stanley, Selous, and others whose names are written large across the heart of Africa. No one was more ready than Sir Clements to encourage these pioneer explorers and to help them in every way as far as the resources of the Society would permit. His hospitality was catholic and generous, and he probably did more than any other man, since the time of Murchison, to raise the Society's reputation to the high standard which it has attained.

As Secretary, he was naturally keenly interested not only in the exploration of Africa, but in the work which was being carried out in other continents, especially Asia. In the exploration of Asia he was intimately associated with the work of such well-known men as Palgrave, Rawlinson, Yule, Trotter, Carey, Strachey, Wallace, Montgomerie, Blakiston, Hayward, Ney Elias, Gill, Hooker, Baber, Littledale, Holdich, Rockhill, and his distinguished successor Lord Curzon. A glance through the volumes of the old *Journal* of the Society, the *Proceedings* and the *Journal* as it now exists will show the vast amount of work of a high character which was carried out under the auspices or by the encouragement of the Society during the forty-two years of Markham's tenure of office either as Secretary, as Vice-President, or as President. It will there be seen that it was not only exploration, in the ordinary sense, with which the Society had to deal, but that even in those earlier years the scientific aspect of geography was already recognized. It was while Markham was still an Honorary Secretary of the Society that this aspect of the subject received more distinct encouragement by the institution of series of lectures by distinguished scientific men on their special subjects. This feature may be regarded as the forerunner of the Research Department of the Society's work, which Sir Clements established soon after he became President in 1893, and which has now been at work for many years, with satisfactory results.

Sir Clements Markham had also much to do with the attempt to raise the position of Geography in English education by offering medals in an examination in the subject open to pupils from the principal public schools. When after a trial of twenty years this scheme proved not so successful as might have been hoped it was decided, in 1884, to abandon it and institute an inquiry into the position of geography in universities and schools on the Continent and in America, and to send abroad a delegate for this purpose. The report he brought back was carefully considered by the Council, and it was determined to appeal to the Universities of Oxford and Cambridge to found Schools of Geography, and the appeal was supported by an offer of pecuniary grants-in-aid. This appeal was successful, and in all the subsequent negotiations and co-operation involved in founding and fostering the new schools Markham took an active part, serving at various times on the Geographical Boards of both Universities. The movement thus initiated may now be regarded as having attained its purpose in raising geographical teaching and research to a level approaching that which it has so long achieved in Continental countries.

In other ways Sir Clements did much to add to the efficiency of the Society. He was, for example, keenly interested in the improvement of our library and map collections, both of which during his time received immense additions, both in new publications and works of historical value. He was also active in promoting the enlargement of the collection of photographs begun during his term of office. Another department, the growth and success of which was largely due to Markham's zeal, is that for instruction in surveying, which before the war broke out had grown to almost embarrassing dimensions. During the many years that this department has been at work a very large number of men, military officers, travellers and colonial officials, have been sent out with a practical knowledge of surveying, many of them having taken the Society's Diploma testifying to the holders' qualifications as trained surveyors.

The foregoing statement may afford some idea of the very varied and important work carried out by the Society during Markham's tenure of office, and largely through his intelligent and never-tiring exertions. The result of all this energy was the obvious necessity of a change in the Society's house. Not only did our various collections increase to such an extent that No. 1, Savile Row became quite inadequate in accommodation, but the work of the Society also grew to such an extent that by the time Markham retired from office the Staff had had to be trebled. It may be noted here in passing that it was during his secretaryship that the Society had made its first move from Whitehall to Savile Row.

As might have been expected Sir Clements' intense interest in polar exploration led to important practical results during his long period of office as Secretary and President. After the Franklin Search Expeditions the British Government ceased for many years to interest itself in polar exploration. But Sir Clements could not allow the matter to rest

there, and it was partly through his persistent advocacy that the last official Arctic Expedition (1874–6) was equipped and placed under the command of Sir George Nares, with Commander (now Admiral Sir) A. H. Markham as Commander of the *Alert*. Sir Clements accompanied the expedition as far as Godhavn, while Commander Markham succeeded under almost insuperable difficulties in reaching 83° 20′ 26″ N., the record latitude reached up to that time. For many years Sir Clements with untiring persistency advocated the renewal of Antarctic exploration on a large scale, and he must be accorded the credit of having been the initiator of the vast amount of Antarctic work that has been accomplished during the last fifteen years. His zeal was amply rewarded when he succeeded in obtaining from Col. Longstaff and other private subscribers, from the Society and from the Government, a sum approaching £100,000 for the equipment of an expedition under Capt. R. F. Scott, which in 1901–4 in the *Discovery* attained memorable results and set an example which has been followed by great achievements. The death of Capt. Scott, whom Sir Clements loved as a son, on his journey back from the South Pole in 1911, was probably the most grievous blow that Markham had ever experienced.

Throughout his long official connection with the Society, Sir Clements kept himself in close touch not only with what may be called its external activities but with its internal organization, in which he took a proud interest. By his friendly, genial and considerate relations with every member of the staff he secured their loyal devotion not only to himself but to the Society, so that the hardest work in carrying out the Society's objects and in maintaining its reputation became a pleasure and not a task. He took a special interest in the younger members of the staff, who were ever eager to gain his approval. Indeed, one of his striking characteristics was his love for the company of young men—Westminster boys, naval cadets, aspiring explorers, and others preparing for their career in life. There are hundreds of men all over the world, not only old boys from the *Worcester* and other training ships, but men in many walks of life, who will admit that their intercourse with Markham was an inspiration and an incentive to do their best and bravest. In such company he was himself again a young man, and nothing pleased him more than to have naval cadets or Westminster boys to lunch and to accompany them after to the theatre or the Zoological Gardens. Hence the widespread feeling of personal loss in his death.

Space forbids our going into further details with regard to Sir Clements' long connection with the Society, and all he did to promote its interests and the objects for which it was founded. He lived to see its membership grow from something well under 1000 to 5300 and its income quintupled. He left it admittedly the greatest Geographical Society in the world, publishing the leading geographical periodical, and in a position to render important services in the gigantic struggle which is being waged for the Empire's existence.

Sir Clements' interest and activities were not confined to the Society or to Geography. He was Secretary to the Hakluyt Society from 1858 to 1887 and President from 1889 to 1909. Every one cognisant of the career of that Society is aware that its success in publishing such a magnificent series of ancient voyages and travels has been largely due to the unceasing devotion and the sympathetic and inspiring influence of Sir Clements. He himself was responsible for something like thirty volumes of the Society's publications, and to the very end he had others in preparation. Besides this he edited two volumes for the Navy Record Society and one for the Roxburghe Club.

In July 1854 Markham was appointed to what was known as the Board of Control of the East India Company and served in the Secret Department through the time of the Persian War and Indian Mutiny. From 1858 to 1862 he served in the Revenue Department of the India Office, and it was during that period that he was deputed to proceed to South America for the purpose of collecting cinchona plants and seeds and introducing them into India. From July 1861 to August 1863 he acted as Private Secretary to Mr. F. G. Baring (Under-Secretary of State for India) who eventually became Lord Northbrook and Viceroy of India. It was about this time that on the suggestion of Colonel H. L. Thuillier, the Surveyor-General of India, Markham was entrusted with the charge of the geographical business of the India Office. One of his first labours was the preparation of the original "Memoir on the Indian Survey," a work which had a good circulation and which was translated into the French and Dutch languages. He also strongly advised the preparation of similar Memoirs for all the Departments of the India Office, but though the idea found several supporters in the office the proposal failed to obtain general favour. The resumption of Marine Surveys in India, which had been abandoned after the abolition of the Indian Navy, was strenuously advocated by Markham and eventually sanctioned; and the creation of a Central Meteorological Department for the purpose of collating and utilizing the scattered observations was another matter which he continued and with eventual success to press upon the attention of the Government. Another task entrusted to Markham was the preparation of the Moral and Material Progress Statement required by Act of Parliament to be laid before Parliament. Mr. (later Sir Mountstuart) Grant Duff, who had obtained the introduction of the section in the Indian Councils Act, providing for the report in question, and who was Under-Secretary of State in 1872, was desirous that a genuine interest should be aroused in Indian affairs by the annual presentation of a thoroughly readable volume. The reports for 1871–2 and 1872–3 were great improvements on their predecessors and gained general approbation, Count von Moltke amongst others having specially expressed his admiration of the book. The discovery of the journals and other papers of George Bogle who was sent on a mission to

Tibet by Warren Hastings, and of Manning, the only Englishman who up to that time had ever visited Lhasa, was due to Markham's research, and the Secretary of State sanctioned their being printed and published at the Government expense. An admirable introduction was prefixed giving an account of Tibetan geography and history and the journals were annotated throughout by Markham.

Sir Clements' interests and activities were as we have shown widespread and altogether he was author and editor of half a hundred works, besides numerous papers and memoirs in the publications of the Geographical and other Societies. In addition to the works already mentioned, reference may be made to his 'Threshold of the Unknown Region,' probably the best summary of Arctic exploration. Among volumes with a geographical interest were his Lives of Columbus, John Davis, Major Rennell, and Sir Leopold McClintock. Other biographies were 'Life of the Great Lord Fairfax,' 'The Fighting Veres,' 'The Paladins of Edwin the Great,' 'Richard III., His Life and Character;' in the last he tried to acquit Richard of the murder of the two princes. Then we have his 'History of Peru,' and 'History of Persia.' Sir Clements had the pen of a ready writer. The facility and rapidity with which even to the end he could turn out work was marvellous. He was too wedded to old ways to dictate or type-write, and his small, clear, angular penmanship was characteristic, the clearness remaining to the last. His almost phenomenal memory was of great assistance to him as an author. He had the history of Polar exploration, of the exploration of Tibet, and other fields, such as certain periods and genealogies, by heart, as well as the minutes of council of the Society, and the great episodes in its career, in minute detail.

Underneath a somewhat abrupt and detached manner Sir Clements concealed strong feelings and a warm and sympathetic heart. He was the staunchest of friends and the indomitable champion of any cause he made his own. Naturally conservative, he was specially jealous of any departure from the traditions of the Society, but as facts show he did not hesitate to welcome new departures which contributed to the promotion of its objects. As might have been expected he had his prejudices and dislikes, but even these, strong as they may have been sometimes, were frequently overcome by an appeal to his better judgment and his heart. Without ostentation he helped many a needy man. He had led the fullest of lives, and had it not been for the misfortune which ended in death, there was every hope that he would have had still several years of life and activity before him.

Sir Clements was the recipient of many honours. He was made K.C.B. in 1896, and orders were conferred upon him by the Sovereigns of Portugal, Brazil, Sweden, and Norway. He was elected Fellow of the Royal Society in 1873, and was Honorary Member of various Academies, and of all the Geographical Societies of Europe and the Americas. Cambridge conferred upon him the degree of Doctor of Science.

In 1857 Sir Clements was married to Minna, daughter of the Rev. James Hamilton Chichester, Rector of Arlington, North Devon, who, with a daughter, Mary Louisa, born in 1859, survives him.

Sir Clements was buried in Kensal Green Cemetery, on February 3, and at the service at St. Michael's, Chester Square, which preceded his funeral, Earl Curzon of Kedleston represented the Society in the unavoidable absence of the President. Other members of Council present were Admiral Sir Lewis Beaumont, Col. Sir Th. H. Holdich, Sir Everard im Thurn, Mr. Reginald Smith, Mr. Somers Cocks, Dr. H. N. Dickson; with Dr. J. Scott Keltie, Mr. E. Heawood and Mr. E. A. Reeves representing the staff. There were also present at the service Lady Markham, Admiral Sir Albert Markham and other relatives, the Colombian and Peruvian Ministers, Dr. Gow, head master of Westminster School, Admiral Sir Arthur Moore, Admiral the Hon. Sir E. R. Fremantle, Sir George Dashwood, Admiral Sir James Bruce, Admiral Sir N. Bowden Smith, Dr. Arthur Schuster (Royal Society), Dr. Smith Woodward (Geological Society), Mr. Albert Gray and Mr. J. A. J. De Villiers (Hakluyt Society), Dr. J. H. Guillemard (Cambridge University), Capt. D. Wilson Barker (Worcester Training Ship), Lady Mary Scott, Miss Scott (sister of Captain Scott), Lieut. Rupert G. England, R.N.R., Mr. Cyril Longhurst (the late Captain Scott's secretary).

The following interesting reminiscences of Sir Clements have been sent by his cousin, Admiral Sir Albert H. Markham, K.C.B.:

Clements Robert Markham, second son of the Rev. David F. Markham, Canon of Windsor, and Catherine, daughter of Sir William Milner, Bart., was born on 20 July 1830 at Stillingfleet, Yorkshire, of which parish his father at that time was Vicar. He was baptized in the drawing-room at Becca Hall, by his great uncle, Archdeacon Robert Markham. From 1839 to 1842 he was at Cheam School, from which he was transferred to Westminster, where he remained until he entered the Navy on 28 June 1844. His first service was as a Naval Cadet and Midshipman on board H.M.S. *Collingwood*, a two-decker, mounting 80 guns, flagship of Rear-Admiral Sir George Seymour, on the Pacific Station. His Captain was Robert Smart, a good officer and a strict disciplinarian. After serving for four years on this station, during which period he visited Chile, Peru, Mexico, California, Rio de Janeiro, the Sandwich, Society, and Falkland Islands, he returned in the *Collingwood* to England. His sojourn in Peru only whetted his appetite for further intimate knowledge of that interesting country and its ancient history, which subsequently was somewhat appeased by a more full and general exploration of the country.

After serving in various ships on the Mediterranean Station, Clements Markham sent in his name as a volunteer for service in the expedition that was fitting out with the object of searching for Sir John Franklin in the Arctic Regions. His services were accepted by the Admiralty, and he was

appointed as midshipman to H.M.S. *Assistance*, commanded by Captain Ommanney, in April 1850. In addition to the *Assistance* were the *Resolute*, Captain Horatio Austin, in command of the expedition, the *Pioneer*, Lieut. Sherard Osborn, and the *Intrepid*, Lieut. Cator. The two last named were steam tenders to the *Resolute* and *Assistance*, which were sailing vessels. The expedition sailed on 3 May 1850, and after a somewhat exciting and perilous voyage through Melville Bay, where the ships were detained by the ice for six weeks, eventually reached Griffith Island in Lancaster South, where they spent the ensuing winter. Markham was the life and soul of the officers' mess, and took a leading part in the organization of theatricals and other amusements, such as lectures, penny readings, etc., to help to relieve the tedium inseparable from a long and dark winter. It was while serving in this expedition that the subject of our sketch began his life-long friendship with Sherard Osborn and McClintock which culminated later on so beneficially to the promotion of North Polar exploration. During the spring of 1851 Markham carried out some important journeys in part of the general scheme that was instituted for the discovery of indications of the Franklin expedition. These led, however, to no definite conclusion regarding the object of the enterprise—namely, the safety, or whereabouts, of the missing men; but much useful geographical work was accomplished. On one of these journeys Markham was away for nearly six weeks, and although many hardships and privations had to be endured, such as are incidental to sledge travelling in the polar regions, he kept his men in good health, and brought them back in safety to the ship. The expedition returned to England in October 1851, when he was awarded the Arctic Medal.

This was his last service in the navy, for after passing his examinations for a lieutenant on board H.M.S. *Excellent*, he retired from the service. He was then free to carry out a long-contemplated plan of visiting Peru, in the ancient history of which country he was much interested; but before doing so he published his charming little work entitled 'Franklin's Footsteps,' being an account of the expedition in which he had taken part. This book was the forerunner of the numerous works subsequently written and published of which he was the author. His travels in Peru, and especially his visit to the ancient city of Cuzco, the splendid capital of the Incas, were all graphically recounted in his work 'Cuzco and Lima' published in 1856. He himself states that his visit to Peru was undertaken "solely with a view to the examination of its antiquities and the enjoyment of its magnificent scenery." His return from Peru was hastened by the news of the death of his father. On his return he was elected a Fellow of the Royal Geographical Society, thus commencing a long and intimate connection with that Society terminating only with his death.

On 23 April 1857 Clements Markham was married to Minna, daughter of the Rev. James Hamilton Chichester, Rector of Arlington, North Devon,

who has been his life-long friend and companion, sharing his joys, partaking of his troubles, always by his side, assisting him in his literary and other labours—a sweet and devoted friend. There is one daughter who survives him, Mary Louisa, born on 4 October 1859.

Always a busy man, although his mind was invariably bent on scientific subjects, more especially in connection with geographical research, he obtained employment from 1854 to 1858, in what was called in those days the Board of Control of the East India Company, and from 1858 to 1877 he was employed in the India Office. He acted as Private Secretary to Lord Northbrook (who at that time was Secretary of State for India) from August 1861 to May 1863. He was also employed as Assistant Secretary in charge of all the work connected with the surveys and geography in India from 1867 to 1877, when he retired on a pension.

Prior to this, in 1859, while serving at the Board of Control, Clements Markham, in view of his undoubted qualifications for the work, was specially entrusted by the Government with the enterprise of collecting plants and seeds of quinine-yielding cinchona trees, and the cultivation of Peruvian bark generally, and transporting them to our Eastern possessions, where, as is well known, that inestimable febrifuge is regarded as almost a necessary of life. The enterprise was a hazardous one for those engaged in the performance of this service, for it necessitated the exploration of almost impenetrable virgin forests in Peru and Bolivia which had hitherto never been described or even visited by English travellers; it was necessary, as much as possible, to conceal from the inhabitants, for reasons that are obvious, the transportation of these seeds and plants to another country, and great hardships and privations had to be endured while travelling through and over the roughest country imaginable. The expedition, however, was attended with complete success in spite of difficulties of no ordinary character. The plants and seeds were obtained, their removal from Peru was satisfactorily accomplished, and their transference to the Neilgherry Hills in India was successfully achieved, and this great success was due to the marvellous energy, the astuteness with which his dealings with the natives were carried out, and the excellent arrangements made by, and adhered to, by Clements Markham, who superintended the entire work both in South America and in India. Before the end of the century, that is, about thirty years after they were planted, millions of trees were growing in flourishing plantations in India; the febrifuge was manufactured locally, and was brought within reach of the poorest people. For this great national service the Government awarded him a grant of £3000. During his travels in the two continents whilst engaged in carrying out this important service, he was accompanied by his faithful loving wife who shared all his hardships and rejoiced with him in the great success attending the enterprise.

On the outbreak of the Abyssinian War in 1867, Clements Markham was appointed by the Government as geographer to the expedition, and

accompanied Sir Robert Napier throughout the entire campaign, and was present at the assault and capture of Magdala. For his services on this occasion he was created a Companion of the Bath, and was awarded the Abyssinian war medal.

After his return from the Arctic regions in 1851, Clements Markham maintained the great interest in everything pertaining to Polar research which he had imbibed whilst employed in the search for Sir John Franklin. He became a great advocate for the desirability of a renewal of exploration in the Arctic Regions, which, after the discovery by Sir Leopold McClintock of the fate of Franklin, had been allowed to remain dormant. In collaboration with his great friend Admiral Sherard Osborn and others he was, after much persistency on his part, instrumental in obtaining the sanction of the Government for the despatch of two ships, the *Alert* and *Discovery*, under the command of Captain Nares, in 1875. It is needless to say that he took the greatest interest in the equipment of these vessels, and actually accompanied them when they sailed as far as Godhavn, in Greenland; and no one gave a warmer or more cordial reception to the officers and men of those vessels on their return home the following year, than he did.

In 1890, after a long term of service as its Honorary Secretary, he was elected President of the Hakluyt Society, and it may very safely be said that no one has done more in its interest than Sir Clements Markham. He has edited no less than thirty volumes for the Society, out of which number he has translated quite half.

In August 1895, when President of the Royal Geographical Society, he was called upon to act as President of the International Geographical Congress, which met in London, a duty he carried out with great dignity and popularity. Honours were showered on him. He was presented by the French Government with a beautiful blue Sèvres tazza. He received the Grand Prix of the Paris Exhibition of 1867. He was made Commendador of the Portuguese Order of Christ in 1874, Chevalier of the Order of the Rose of Brazil—member of the Imperial Academy of Germany; and of the Royal Society of Göttingen. The King of Sweden conferred upon him the insignia of a Commander (1st class) of the Order of the Pole Star. In 1896 he was created a knight Commander of the Bath and was knighted and invested by Queen Victoria at Windsor Castle. In 1907 the King of Norway appointed him a Commander of the Order of St. Olaf.

It may very truly be said that Clements Markham was the father of modern Antarctic research. It was he who originated and caused to be despatched the late Captain Scott's first Antarctic Expedition, and it was due to his insistency, and his urgent and persistent entreaties, that the Government was induced, somewhat reluctantly, to send out the relief ship after two years had elapsed without any information being received regarding the safety, or otherwise, of the expedition. He never lost

interest in Polar exploration, no matter in which hemisphere the work was being carried out.

His was a most lovable nature, and he was always ready to hold out the hand of friendship, accompanied by kindly words of advice and encouragement to those young officers of the Royal Navy, and also our mercantile marine (and they were many) who went to him for advice and assistance. No one appealed to him in vain—he was at all times ready to befriend the friendless. The world is all the poorer by his death, and those who knew him will always mourn their loss.

He was especially attracted to young naval officers and children, and was never so happy as when surrounded by his young friends, entering into their fun and amusements, or perhaps relating to them stories connected with his travels and adventures. His memory was wonderful, and remained unimpaired to the day of his death. Not only did he remember important historical facts and dates, but even the slightest trivialities that had come to his knowledge half a century before. He was a prolific and versatile writer, and has published, in addition to those books he edited for the Hakluyt Society, over half a hundred volumes on various subjects, principally historical, biographical, and geographical, besides contributing numerous articles to the *Geographical Journal*. He delivered lectures before the Society of Arts, and contributed articles for the *Proceedings of the Society of Antiquaries*, of which he was a valued and esteemed Member of Council. He also wrote several articles for the 'Encyclopædia Britannica,' and contributed all those chapters dealing with voyages of discovery in the 'History of the Royal Navy,' edited by Laird Clowes. In 1912 he was elected President of the International Congress of Americanists. The following year his old Westminster colleagues and friends presented him with a full-length portrait of himself painted by George Henry, A.R.A. A brief notice such as this cannot be more appropriately closed than by adding a copy of the telegram sent by His Majesty to Lady Markham, on being informed of the death of her distinguished husband:

"The King regrets to hear of the sorrow which has befallen you, and desires me to convey to you the expression of his sympathy. His Majesty has known Sir Clements for many years, and realizes how much the country is indebted to his long years of study and research."

Letters and telegrams of condolence and sympathy have been received from the Italian Geographical Society, the Norwegian Geographical Society, the Danish Geographical Society, Dr. Fridtjof Nansen, General Sir Reginald Wingate and other Fellows in the Sudan, Captain Royds, Dr. Sven Hedin, Dr. Otto Nordenskjöld, Señor Joaquim Bensaude, etc., etc.

DISTRIBUTION OF NATIONALITIES IN HUNGARY.

B. C. Wallis.

Read at the Afternoon Meeting of the Society, 18 *November* 1915.
Maps, p. 240.

THIS paper falls naturally into two parts, of which the first deals with the method of mapping the facts concerning the distribution of population and nationalities, and the second deals with some of the results which refer to the peoples of Hungary.

The work has arisen during the compilation of the 1/M. map of Europe which is being actively prepared under the auspices of this Society, and is largely due to a suggestion from Mr. A. R. Hinks that the utility of the 1/M. map might be considerably increased if the facts concerning the distributions of population and of nationalities could be demonstrated in relation to the areas shown on the sheets of the 1/M. map.

The maps which are here submitted for criticism are based upon the Buda-Pest sheet, and this area has been investigated largely as a result of the accident that my first attempt at compilation was confined to the checking of the Buda-Pest sheet of the International Map which had been prepared for the Hungarian Government. This accident may be described as fortunate, as Hungary probably presents the greatest difficulty to the map-maker since there are no less than seven different nationalities under Hungarian rule.

Density of Population.

Demographic statistics regarding Hungary are tabulated in the report of the 1910 Census with reference to five kinds of administrative divisions. The largest areas, the counties (varmegye), are useless for the purpose in hand on account of their size. The next divisions are twofold, the county districts (járás) and the towns. These divisions are a convenient size for a first attempt to provide a general survey of the country and have been used in the construction of the general maps.

The smallest divisions are the communes (Község) which have been made the basis of the detailed maps.

The Hungarian towns are classified under two heads as municipalities (törvényhatósági jogú város) and as towns with an organized council (rendezett tanácsú város).* For convenience it will be well to use the terms "municipalities" and "townships" in reference to this administrative distinction. In the Census report the municipalities are excluded from, and the townships are included within, the county areas. The administrative distinction is of little practical importance in reference to population since

* It would appear probable that the distinction between these classes of towns resembles the distinction which can be drawn between a County Borough and an Urban or Rural District Council.

many of the towns are "garden cities," and are in reality loosely concentrated rural communities which differ from those industrial or mining communes which have a more distinctly urban character. For example, the municipality of Debreczen has an area of 625 square miles and an average density of population of 245 per square mile; the township of Mezötúr has an area and density of 160 and 161 respectively; on the other hand the municipality of Nagyvarad contains 3420 people per square mile in an area of 31 square miles, and the township of Komarom contains 12½ square miles with an average density of 1800 persons to each. Consequently the distinction between urban and rural communities must be determined from the population maps on the basis of the density of population.

The Density Maps.

The first map (A) shows the distribution of the rural population by means of the traditional method which is based upon the consideration of each district as a separate whole. The scheme of shading distinguishes five areas—those which contain densities between 64 and 128, 129 and 192, 193 and 256, 257 and 320, 321 and 384 respectively. No district has a smaller density than 64 persons per square mile, and areas with more than 384 people to the square mile are excluded as urban areas. Each district is shaded separately in accordance with this scheme, so that there frequently occurs a break in continuity when, for example, the arbitrary line of a political boundary separates on the map an area with a density greater than 320 from an area with a density of less than 193 persons per square mile; that is, the political boundary is used for a decreased density which omits two intervening divisions in the scale.

This outstanding defect is to some degree remedied in the second map (B) which is based upon the principles which underlie contour-lines. The number representing the average density for each district is mapped in the geographical centre of the district and these numbers are treated as "spot-heights," and used to draw "population lines." The great advantage which is gained by this method is indicated at once by the continuity of the area of comparatively dense population which is seen to stretch south-eastward from Buda-Pest to Szeged, across the plain between the Danube (Duna) and the Theiss (Tisza) and to continue due south to Ujvidek and almost due east to include Gyula, Makó, and Arad.

The third map (C) shows the results of applying the contour method to the small communal areas; in place of one "spot-height" used in the second map, from twenty to thirty "spot heights" are used in this case, so that the third map is much more detailed than either of the other density maps. In place of the large areas of uniform population which are indicated in the second map, it appears that the people are distributed much more unevenly; for example, the area east of Lugos is shown on the second map to have a sparse population extending from the Danube at Orsova almost as far north as Kolozsvár, the detailed map demonstrates that

tongues of more closely packed people penetrate eastwards and in some cases almost entirely cross this area.

It has been contended that a good map of an ordinary type should provide some indication of the relative density of the population by the frequency with which towns are inserted; *e.g.* an area of dense population should show many towns. In the 1/M. map the towns are classified into six groups in accordance with their importance, and it may be well for a moment to consider whether the towns on the Buda-Pest sheet are a sufficient index of the relative grouping of the people. The fourth map (not reproduced) shows the towns of the Buda-Pest sheet; and in comparison with the details of the third map it appears that a very fair idea of the distribution of the population is conveyed by these towns. This fact may be regarded as some justification for the comparative paucity of town names on the sheets of the 1/M. map.

The Distribution of Nationalities.

The second set of three maps attempts to show the proportional distribution of the Hungarian nationalities in the area covered by the Buda-Pest sheet. This area does not include many Slovaks or Ruthenes, but includes typical areas in which the people are predominantly Magyar, German, Rumanian, Croat, or Serb.

The basis of nationality is that which is used in the Census Report, namely "mother tongue." Controversy rages round the meaning which is to be attached to this term; it is alleged, for instance, that a visitor may find that the majority of the inhabitants of a commune speak German although the Census Report states that these villagers are almost all Magyars. Again, it is asserted that the Census officer, who is necessarily a Magyar, will include as Magyars those of other nations who state that they speak Magyar "more willingly" than the speech they learnt in childhood. A somewhat specious argument is put forward in the case of the Germans in Hungary; it is stated that the Census officer records a letter "m" for Magyars and a letter "n," from the word "német," for Germans, and that in computing the totals he misreads many of the *n*'s as *m*'s. After working at the Census Report for many months I am of the opinion, however, that the report is substantially accurate, and that on the whole the varied objections are probably based upon isolated instances. The results, which are indicated on the "nationality" maps, are probably true within an error of two or three per cent.

"Nationality" in this paper, therefore, is based upon speech; usually upon the speech of the mother at home, and in other cases upon a speech deliberately used to represent some aspirations of the individual to be counted as a member of the nation whose speech he uses. Rumanians, Slovaks, for example, tend to persist in a refusal to use the Magyar tongue, and only the Germans seem to speak Magyar with any feeling of satisfaction. These opinions have been reached slowly as the investigation

of these matters has gradually become more detailed and in face of a prejudice against the accuracy of the Census Report, which was apparently open to the objection that it was compiled in order to demonstrate effectively the steady Magyarization of Hungary.

It may be wise to state, also, that I have examined all the "nationality" maps which I could find and studied the methods by which various cartographers have attempted to represent the complex conditions which prevail in Hungary. None of the maps which I have seen presents the facts adequately; for example, in certain maps there is no indication that the so-called Magyar areas contain more Magyars than would amount to half the population, and few maps attempt to give any presentation of the facts which arise where two nationalities overlap. Consequently, the maps which are here shown are based upon two methods which have not, so far as I can determine, been used before.

In the fifth map (D) the percentage distribution of the nationalities is indicated numerically for each district, and an attempt is made to give a pictorial presentation of the grouping of the peoples by the use of distinctive colours for each nationality. This method yields a map which is extremely useful for intensive individual study, but which fails because it gives very little notion of the areas in which the Magyars, for example, form at least 50 per cent. of the population. This map suffers also from the defect noted in the first map since it is similarly based upon districts which are considered in isolation.

The contour method is again used in the sixth map (E), which may be regarded as a combination of six separate maps, one for each of the six nationalities, Magyar, German, Slovak, Rumanian, Croat, and Serbian. The Magyar, for example, are indicated by five different forms of shading in the groups—over 95 per cent.; 76 to 95; 51 to 75; 26 to 50; and 11 to 25. Only the Rumanians show five similar groups. There is no district which contains more than 95 per cent. of Croats or Serbians, although the other groups are all represented. The Germans and Slovaks are not sufficiently numerous in any district shown on these maps to form more than 75 per cent. of the population, so that these peoples fall into the three lower groups.

By using separate colours for the "population lines" and for the corresponding shading the map depicts quite well the grouping of the nationalities; it is possible to see at a glance the areas where the population is entirely Magyar or Rumanian, and it is equally possible to detect at once the areas in which the population is very mixed. Similarly the boundary area which separates Magyar from Rumanian is distinctly marked to the north-east of Arad. On the whole, this map gives the impression that there tends to be a clear line of demarcation between each nationality and its neighbours; with the possible exception of the Germans who have been noted for their ability to disappear into the population by whom they are surrounded.

I have attempted in the seventh map (F) to investigate the boundary-line between Magyars and Rumanians. By using the "contour method" for the communes, which number at least 5000, and by completing the Magyar map first and then completing the Rumanian map quite separately from the Magyar map, it has been possible to obtain the lines here shown. To demonstrate the way in which the lines fit, I have marked the Rumanian lines upon tracing-paper and have only placed this tracing over the Magyar map in preparation for this meeting; there has been no atttempt at adjusting one set of lines to fit the other set, and it appears that the closeness with which the lines fit is a demonstration of the validity of the statement that only a very narrow strip of territory separates the area where the Magyars number at least 75 per cent. from the area where the Rumanians preponderate to an equal degree.

This concludes the first part of the paper, and I would invite your criticism and suggestions concerning the cartographical methods which have been adopted.

The Buda-Pest Sheet.

Hungary consists of a plain ringed round, except when Hungary is bounded by the Danube, by elevated land, and the area shown on the Buda-Pest sheet may be taken as typical of the whole country since it contains three portions: in the middle the southern portion of the plain, to the west the elevations which lead towards the Alps, and to the east the elevated area of Transylvania which culminates along the boundary in the Carpathian heights.

The Distribution of the People.

The plain is more densely peopled than the elevated areas, and the area on both sides of the Theiss contains more people than any other area except that which surrounds Buda-Pest. This area is notable for the size of the towns, which are little more than "garden city" dormitories for an agricultural population. For historical reasons the people have not lived upon the land which they farmed. Their houses are grouped in a convenient centre beside broad straight streets which are merely portions of the great roadways that cross the plain. Each house stands in its own ground, so that the houses straggle in all directions away from the central market-place. The countryside is practically destitute of buildings except for the roughly constructed sheds in which tools and other farming necessities are stored. Administrative centres are infrequent, the communes and towns are very large in area, and railways, roads and canals are numerous.

West of the Danube, in Hungary proper, the communes are small and the people tend to be concentrated in small areas. Villages are numerous and the people are not quite so numerous as those of the plain. In the south, between the Drave and the Save there are fewer people similarly grouped.

In Transylvania the people are concentrated along the valleys. The communes are frequently small and the people are probably only half as numerous as those of the plain.

A curved line from Versecz through Temesvár, Arad, Nagykaroly and Szatmar-Németi lies just to the west of this area, and separates the land lower than 200 metres from the elevated area which usually exceeds that height and at the same time separates an area with an average population above 128 per square mile from an area to the east where the density of the population only exceeds 128 per square mile along the valley bottoms. Transylvania is scantily peopled.

The Distribution of the Nationalities.

The Nationalities of Hungary inhabit separate communes; the nations do not mix. Out of over 7500 communes which have been tested, more than half contain at least 95 per cent. and nearly a third contain between 75 and 95 per cent. of one nationality, so that in five communes out of six at least three-quarters of the inhabitants belong to a dominant nationality. It is exceedingly rare to find a commune in which two nationalities are represented in approximately equal proportions.

This fact accounts for the difficulty which was experienced in connection with the seventh map; it was almost impossible to draw "population lines" for 25, 50, 75 and 95 per cent. for Magyars and Rumanians on the same sheet.

On this account the sixth map is defective, for it suggests that Magyars are mixed with Rumanians on the east, Serbians on the south, and Germans on the south-west. This is not the fact, since the population lines 25, 50, 75 and 95 per cent. usually run so close together that on the scale of one in a million they ought frequently to be indicated by one thick line in place of four thin lines.

In many districts probably not more than 5 miles separate a population which is definitely Magyar from another which is equally definitely Rumanian. A comparison between the map showing the Magyars and that showing density of population suggests the idea that in those areas which constitute "Magyar islands" set in the midst of Rumanians the Magyars form a definite addition to the population superposed upon the Rumanians.

The narrow line of demarcation merits emphasis since it demonstrates conclusively that the Magyars have not succeeded in mixing with the other nationalities. Partsch, in his 'Central Europe,' of which the English edition was published in the "Regions of the World Series" in 1903, refers to the position of the Magyars in these words: "The various nationalities are being brought more and more completely under the influence of this Magyar centre. The desire of Hungarian statesmen is to mix all the peoples of their country into a loving cup, whose main flavour should be Magyar. . . . Thus Budapest is, in a truer sense than any

other town of Central Europe, the heart whose beat regulates the circulating blood of a strong national life" (pp. 225–6).

In this connection the following table may be considered :—

PERCENTAGES OF THE POPULATION OF HUNGARY, WITHOUT CROATIA.

	1880.	1890.	1900.	1910.
Magyars	46·7	48·6	51·4	54·5
Germans	13·6	13·1	11·9	10·4
Slovaks	13·5	12·5	11·9	10·7
Rumanians	17·5	17·1	16·6	16·1
Ruthenes	2·6	2·5	2·5	2·5
Serbo-Croats	4·6	4·5	3·7	3·6
Others	1·5	1·7	2·0	2·2
Total civil population in thousands	13,750	15,163	16,722	18,142

These values indicate that the proportion of Magyars has increased at the expense of the other nationalities, and apparently show considerable progress by the Magyars towards the ideal mentioned by Partsch. Official Hungary congratulates itself upon this apparent progress in these words: "The proportional growth of the Magyars has greatly exceeded that of the inhabitants with any other mother speech, and this may be attributed, in part, to the more intense natural increase of the Magyar race, and, in part, to the pacific propagation of Magyar culture; but quite specifically to the rapid spread of the Magyar tongue in the towns. The strength of the Magyar element is proved by the fact that in 31 out of the 63 counties of the mother-country it is in an absolute majority and in a relative majority in 4" (Census Report, pp. 18–19).

It will be well to separate these statements into their constituent propositions and to discuss each one separately. They are: (i.) the Magyars have increased more rapidly than any other nationality; (ii.) the Magyar tongue has spread rapidly in the towns; (iii.) the Magyar race is more fertile than the other nationalities; and (iv.) Magyar culture has been propagated peacefully.

The chief of these propositions may be put aside for the moment until the others have been discussed. First, then, the Magyar increase in the towns. The Magyars monopolise political posts, they flood nearly all the liberal professions, education, literature and art. Two out of three municipalities are predominantly Magyar, and three out of five townships have Magyars as more than half the population. It has been shown that the Magyars exclude the other nationalities from the northern portions of the plains precisely in the area where the population is densest and the towns are most numerous. Beyond the limits of this Magyar block which ceases abruptly, there are in the towns mainly for administrative purposes islands of Magyars, who are a ruling caste settled among the

other peoples. Towns which were formerly German have become Magyar. In thirty-two towns the Magyar gains have equalled German losses, and in seven other towns the German losses have amounted to half the Magyar increase. On the other hand, certain towns have been counted as Magyar gains since the other nationalities have changed their proportions in such a way as to leave the Magyars numerically the strongest nationality. For example, imagine a case where the Germans declined from 45 to 30 per cent., and the Rumanians increased from 12 to 27 per cent., while the Magyars remained constant at 37 per cent.; such a town would be included as a Magyar gain. This is an exaggerated illustration, yet it signifies one kind of change which is accounted as Magyar progress. On the other hand, R. W. Seton-Watson has calculated that during the decade 1890-1900 changes occurred in 1109 communes in the nature of the dominant majority; the Magyars gained communes from Germans, Slovaks, Rumanians and Ruthenes, but lost nearly twice as many communes as they gained. The Rumanians achieved a net gain over the Magyars of 250 communes. The conclusion is, therefore, that the Magyar gains in the towns have been chiefly made from the Germans and have been partly balanced by losses in the communes.

Secondly, the Magyar race is the most fertile. In considering this question it is well to define the terms to be used. Suppose an area contained 1000 people in 1900, and that during the inter-censal decade the births had exceeded the deaths by 100, and that the census for 1910 enumerated the population as only 1050; then for that area 100 represents the "natural increase of the population," and the difference, 50, between the calculated population, 1100, and the actual population, 1050, in 1910 represents a "deficit" due to migration. For purposes of comparison let us consider the conditions in specific areas where the population belongs almost entirely to one nationality. There is a group of six counties and five municipalities where the Magyars form at least 95 per cent. of a population of nearly two millions, *i.e.* about a fifth of the total Magyars in Hungary. In this area the excess of births over deaths varies from 6 to 17 per cent. of the population, and yet there is a deficit in the population due to migration. This deficit more than counterbalanced the gains in the remaining four municipalities, so that over the whole area the net deficit amount to 3 per cent. of the population.

In a definitely Rumanian area containing about a third of a million people, the natural increase due to excess of births over deaths ranged from 9 to 12 per cent., and the deficit amounted to 5 per cent. of the population. Similar definitely Croat and Slovak areas showed a natural increase ranging from 11 to 18 per cent. and a deficit of 6 per cent. in each case. Two questions are intermingled in these statements; let us separate them. The first refers to natural increase, which works out, on the average, for Magyars, 12 per cent.; Rumanians, 11 per cent.; and Croats and Slovaks, 15 per cent. The second refers to migration, which

is greatest among Slovaks and Croats and least among Magyars. Now, migration, like warfare, tends to increase the death rate among the excess of aged people left behind, and to decrease the birth rate since the fertile people are those who migrate. Consequently these facts tend to show that the Magyars are not the most fertile of the Hungarian nationalities.

The character of the migration deserves passing notice; the Slovaks and Croats usually leave Hungary while many Magyars merely migrate to other places within that country. This fact tends to emphasize the greater fertility of the Slovak and Croat nationalities, and serves to account to some degree for the decline in the numbers of Slovaks and Croats. At the same time the proportionate increase of the Magyars is partially accounted for by the excess of non-Magyar over Magyar emigrants from Hungary, mainly to the United States.

Thirdly, Magyar culture has been propagated peacefully. In a book * published in England with the intention of moulding public opinion in this country to a favourable view of Magyar democratic successes, Dr. Julius de Vargha wrote, "It is particularly in the towns that the power of Magyar culture is at work as a permanent force acting voluntarily, without the least sign of constraint, in the interests of the creation of a uniform speech." To demonstrate the falsity of this proposition it will suffice to refer to the work of those whose acquaintance with Hungary is more intimate than mine. Partsch states: "In no other state of Europe has the government been so successful, and in no other except Russia so unscrupulous, in the means by which it has tried to force upon the other elements of the population the language of the dominant majority." Seton-Watson deals with the case more specifically when he states that the official Magyars treat the nationalities as foreign interlopers, gerrymander the elections, make justice subservient to political purposes, persecute the non-Magyar press, and impose petty annoyances and restrictions upon those Slavs and Rumanians who remain loyal to the language and traditions of their ancestors.

Magyar culture is not propagated peacefully.

Next the main proposition that the Magyars have increased more rapidly than the other nationalities. This proposition is, no doubt, true in the main; even after allowance has been made for the effect of the excessive emigration of the non-Magyars.

The greatest progress has undoubtedly been at the expense of the Germans, and we can, therefore, understand the fierceness with which German writers impugn the accuracy of the Hungarian statistics. When we remember that the Magyar language is the only speech that is favoured in the schools, that official positions are only open to those who use the Magyar tongue, that official documents are promulgated in Magyar only, that the use of a non-Magyar speech meets with continuous opposition,

* 'Hungary of To-day,' p. 24. By members of the Hungarian Government, etc. Edited by Percy Alden, M.P.

it is not surprising that the numbers of those who speak Magyar have steadily increased. But the mere increase of numbers is of little account when it has been shown that the official enumerations of the causes of the increase are specious.

Let me attempt to suggest the real state of affairs. The Magyars do not mix with the other nationalities and they have suffered less by emigration. Magyars are sent to carry out the administration of the areas inhabited by the other peoples, and the whole government machinery is used to make the lot of these outposts of the Magyar nation as comfortable as possible; the railway lines are planned to develop the towns in which they live, the famous zone-tariff is arranged to benefit Magyars almost exclusively, the judicature, the executive, all manner of preferment is a Magyar preserve. Consequently, Magyars form the upper classes of society. Consequently, the adaptable German espouses the Magyar cause and his children are enumerated as Magyars, and the number of Magyar converts is increased by all those of weak character among the other nationalities who are unable to withstand the political and social pressure to which non-Magyars are subject.

Geographically, the vaunted Magyar progress counts for little, since the stubborn intractable hill-men of Transylvania and the Northern Carpathians persist in their efforts to remain true to the languages and traditions of their forefathers. With all the resources of modern civilization the dwellers on the plains have failed to exert much influence upon the hill-men by whom they are almost entirely surrounded. The very fierceness of the efforts of the Magyars is, in itself, a confession of failure; and the publication abroad of statements deliberately intended to hoodwink the foreigner is a lasting testimony to the unworthiness of the Magyar cause.

Finally, a word upon the possible political boundary of the Magyar nation in the future. It has been shown that Transylvania is predominantly Rumanian and that the Magyars who govern the land live in isolated communes. The Magyar boundary to the east should therefore run along the edge of the Hungarian plain, leaving the Rumanians, like the Swiss, entrenched among their hills and valleys. The northern boundary should separate the Slovak and Ruthenian hill-men from the Magyars. Croatia contains very few Magyars, and here the Drave forms a convenient boundary.

The boundary towards the south presents greater difficulties. North of the Danube the Serbians and the Rumanians, as well as numerous Germans, are not separated from the Magyar block by any convenient geographical limit. The Theiss runs north and south and is therefore useless. It will be necessary to resort to an artificial line of demarcation. Such a course has a political justification; for the present Austria contains the Upper Danube, the new Magyar state will extend across the Danube westwards, so that the new Serbia may well extend across the Danube northwards.

If the war should do no more than save Serbians, Rumanians, Slovaks, and Ruthenians from a continuation of Magyar oppression, the efforts of the Allies would not be wasted.

After Mr. Wallis read the paper a discussion followed.

Prof. LYDE: The first thing that I would like to say is that, obviously to any one who does any even elementary work in that line there is an enormous amount of patience and ingenious work in these maps. I have known for years that Mr. Wallis is one of the most ingenious persons in London in this kind of statistical work. What I wish is that he would always use this gift he has to plot maps that really have geographical significance. He has two maps there which give information that is most valuable. They suggest the whole basis of the hostility of the Magyars to the Rumanians. The Magyars and the Rumanians are both essentially lowlanders. Directly you get above the 600 contour-line, west of the Raab, in the Bakony Forest, north of Fünfkirchen and elsewhere, there are no Magyars—they are lowlanders. So are the Rumanians. They only went up into the hills because they wanted refuge, and they have always been trying to come down from them. I saw only the other day an article by one of those people who are rather prejudiced against Magyars, telling how the Rumanians come up to the hills for their summer pasturage with their flocks. That is really "upside down." They lived up there, and they came down on to the plain. They still have the old link, and it is because of that link they have any connection with the Rumanians on the other side of the mountains, for the people are distinctly different east and west of the Carpathians, even in religion. It is because these Transylvanian Rumanians are always trying to percolate down on to the lowland that there has been this essential hostility between them and the Magyars. I do not hold any brief for the Magyars except as to the Magyar peasant, who is a very fine type, as is the Bulgarian peasant; both of them are admirable types. The Slovak people, too, went up into the hills in the same way, for refuge, safety, and freedom, and they got it up there amongst these barren craters. But, because they were up there in those conditions, of course they were backward—so much so that they have never kept in touch with the Moravian plateau, although the people are of the same tongue and racial affinity: still less have they been tempted to come down on to the Magyar plain. The Magyar patch on the right-hand side of the 7*a* map is a strategical relic, planted down there as the Saxons are planted down farther south. I believed you could not draw a true frontier between the Magyars and the Rumanians, and I am most grateful to Mr. Wallis for letting me see this convincing line. If Mr. Wallis would use those maps to put down for us these populations on a physical map, then they would be illuminating. [Prof. Lyde did not know that these maps have been prepared for superposition on the 1/M. map, which shows the physical features.—ED. *G.J.*] You would have your Slovak population up there in the mountains, and you would have these Rumanians always trying to percolate down from this plateau on to the plain, and in consequence always having friction with the holders of the plain. It is most interesting that there is a very narrow belt like this. As to the south I do not agree with Mr. Wallis. Just as the Magyars will never go up to a highland, so they will never come down into swamp. Look at a physical map and then compare it with the Magyar population. I cannot tell you why, but directly the swamp appears, the Magyar disappears off the map, and in comes the Slav, *e.g.* the Serbians east of the Drave. You get German settlements there too, but mainly Slav. The essential thing is that these people are types associated

with types of country, and the Magyar is associated essentially with the fertile plain. He won't go up above 600 feet, and won't go into the swamp. I would draw the Magyar racial frontier right up to the Drave, and include in it all the land that is definitely swampy again to the north. On the other hand, I believe that a river is the right political frontier and that you should have the frontier on the river. I am very grateful to Mr. Wallis for these two maps because they have given a lot of information that is convincing.

Sir HENRY TROTTER: I should like to thank the lecturer for his most interesting lecture and the way in which he has shown how the varying densities of population ought to be shown on a map. It is new light to a great many of us; certainly it is to me, and I think we ought to be very grateful to him for taking the subject up and devoting to it so much trouble.

Mr. FAIRGRIEVE: The only thing I would like to say is that it is extremely interesting that Mr. Wallis has adopted the line method of showing the distributions of populations and that he has obtained such satisfactory results. It came to me rather with a shock that it had not been done previously in this way.

Miss S. NICHOLLS: I must say a word in defence of the application of statistics to Geography. If you compare mere descriptions of a region you will find that no two people entirely agree. But if the statistical facts are worked out carefully by the geographer you will get a result that is certainly true and which enables you to receive new impressions by a shifting of your point of view. For my part, to-night I have learned a great deal in regard to the distribution of nationalities in Hungary, as the result of the sifting of statistical data by our lecturer, who, as Prof. Lyde has truly said, has a genius for such painstaking work. I believe that I am right in saying that even Prof. Lyde confessed to having learned something on the distribution of nationalities on the west border of Transylvania.

Mr. MAUDSLAY: It is quite evident that Mr. Wallis has put the matter before you in an extremely clear-headed way, and it will, I am sure, be your wish to offer him a very hearty vote of thanks.

Mr. WALLIS: This is a sort of interim report. Some of these maps were shown to the British Association. We obtained one set of opinions there, and have gained another set here to-day; the result of it will be that Prof. Lyde will get what he wants. He will have the Budapest sheet as it has already been published, and we intend to give him a map with the population lines so that he can put the two maps side by side and draw his own conclusions; but until we had some definite ideas as to the utility of these methods and some support that we were on the right track we did not feel quite justified in starting the inquiry and publishing it as an original scheme. Mr. Fairgrieve said he was astonished the line method had not been used before. I believe the method has been suggested in Germany, but I do not know of its application. The swamp that Prof. Lyde talks of is quite clearly indicated on the statistical map; it is inhabited mainly by Serbs and Germans, and the Magyars hold aloof from it. The suggestion was made that we ought to show the population lines on a special edition of the 1/M. map for political purposes, and that was why I undertook to do it: it has been done as war work. The paper is an interim report—intended to stimulate suggestions. I hope to present the completed work at a future meeting.

THE NATURE AND FORMATION OF SAND RIPPLES AND DUNES.

W. J. Harding King.

Read at the Afternoon Meeting of the Society, 16 December 1915.

THE observations upon which this paper is based were made during seven winters spent in the Algerian Sahara and the Libyan desert, the principal dunes examined being those of the El Wed district in the south of Algeria, and those found near the Egyptian oases of Kharga, Dakhla, and Farafra and in the more central parts of the Libyan desert.

Before dealing with the dunes and ripples themselves it is necessary to consider the nature of the material of which they are composed. It has several times been suggested that sand is of a semi-fluid nature. I think that suggestion a misleading one, and that if taken too literally it may lead us very far astray; and as it has an important bearing upon the connection between dunes and waves it is necessary to consider it rather carefully.

A fluid has been defined as "a portion of matter which is unable to support a steady longitudinal stress without lateral support" (Watson's 'Text-book of Physics,' p. 138). It is quite true that a heap of sand can only support a stress under certain conditions, but a single sand grain always can—consequently we must regard sand as being solid or rather a collection of solids. These small particles are fragments of rock, and so sand must be of the same nature as shingle or a pile of boulders—the only difference between the three materials being in the size of the particles.

The reason that sand has been described as a "semi-fluid" is apparently because—like a fluid—it can be poured. But so can shingle; if a cartload of shingle is tipped up the stones will be poured out upon the ground: so if we are to assume that everything that can be poured is a "semi-fluid," there will remain nothing whatever in nature that we can describe as a solid. Except that sand can be poured it has none of the attributes of a fluid. There is no cohesion between the particles, there is no capillarity, no diffusion of different kinds of sand, and what is of most importance for our purpose there is no surface tension and gravity acts upon sand in a different manner from a fluid. The action of gravity upon a fluid that is allowed to come to rest is to form a plane surface—in other words the angle of rest of a fluid is 0°—but in the case of sand the angle of rest is about 30°, and this is a most important point when we come to consider the connection between dunes and waves, as it affects the force of restitution required to keep up a wave motion.

Other earthy substances besides sand will form ripples and dunes, but —except that they may have slightly different angles of rest—the same arguments apply to their being solids and not fluids. Gypsum dunes occur

in Mexico and in other places and have been illustrated and described in this *Journal* (D. T. MacDougal, *Geogr. Jour.*, February 1912). Dunes of clay granules are also reported from near the mouth of the Rio Grande by G. N. Coffey (G. N. Coffey, *Journ. Geol.*, **17**, pp. 754, 755 (1909)), who describes them as being long narrow clay ridges, often covered with vegetation, and sometimes several miles in length, 200 or 300 yards wide and 30 feet high. He found them situated in very level marshy land. At the mouth of the Arroyo Colorado—an old outlet of the Rio Grande—he states he found other dunes 20 feet high, which from a distance appeared to be of "almost white drifting sand," but which on examination proved to consist of granules of friable clay in motion under the action of the wind. He states that these clay dunes were almost always associated with a lagoon.

In the Libyan desert I have several times come across clay ripples formed of the same friable clay granules, and on one occasion I found some small dunes of a roughly crescentic shape, oriented in the same way as sand dunes of the same type, composed of sand largely mixed with clay and covered with pebbles some of which were nearly half a centimetre in diameter. The entire surface of these dunes was as hard and compact as the desert surrounding them, and though a fairly strong wind was blowing at the time I passed them, I could not detect the slightest movement in any of the material of which they were composed. They gave me the impression of being so compacted as to be entirely stationary and of having been formed at a very remote date. As I was unfortunately short of water at the time and consequently hurrying back to a well, I was not able to afford the time to unpack a camel to get the necessary instruments for taking exact measurements. The dunes were scattered rather irregularly over a patch of desert, say 300 yards up and down wind, by perhaps 100 in width; they ran up to about 5 feet in height.

In his paper "On the Formation of Sand Dunes" (*Geogr. Journ.*, March 1907), Dr. Vaughan Cornish raises a question as to the connection between ripples and dunes. He suggests that "in the case of transverse dunes in deep deserts there appears to be actual continuity between ripple and dune, the latter being (on this supposition) old ripples." The question is an important one because, if dunes are merely overgrown ripples, I think it is clear that they must both be formed in the same way; but I am inclined to think that this is not the case.

In the case of all the dunes that I have seen I have always found that whatever their size—they were sometimes over 100 feet high—the ripple marks upon them were never more than about half an inch in height, and if the supposition that these large dunes develop from small ripples be correct, one would expect to find ripples in all stages of development from half an inch to the size of the largest dune.

I much prefer the view—which appears to be the one to which Dr. Cornish inclines himself—that ripples change with every wind that blows

with sufficient strength, and consequently do not last long enough to develop into dunes. I very much doubt whether ripples could develop beyond a certain size, even assuming a wind from a constant direction. So far as I have seen the ordinary rippling on a dune never develops much beyond 4 inches in average length, though sometimes for two or three weeks at a time in the Libyan desert the wind will blow steadily from a northerly direction—sometimes with great force.

The question is not quite so simple as would at first sight appear. Dr. Cornish, in his paper on "The Sand Dunes bordering upon the Nile Delta" (*Geogr. Journ.*, March 1907, Figs. 21 and 22, p. 22), illustrates some small sand forms that he found by the side of the Nile, which he describes as being "not more than 4 feet" in height. He calls these "dunes," and judging from his photographs I agree with his description.

On the other hand I have seen, in the desert to the south-west of Dakhla oasis, sand forms that I at the time put down as being ripples, though I am not sure that dunes would not have been the more accurate description. As is so often the case in a desert journey I was not able to spare the time to take any accurate measurements. In shape they were intermediate between a crescent and a transverse dune. I estimated the largest of them as being about 5 feet high, the smallest being perhaps 2 feet, and paced them to be 30 to 80 paces apart. They resembled the clay dunes I have described in being composed of highly compacted sand in which there was apparently a slight mixture of clay. Like the clay dunes they were covered with pebbles and were probably almost, if not quite, stationary. They were oriented in the same way as crescent dunes in the same part of the desert, that is with their steep sides towards the south. The distances between them appeared to be entirely unsystematic, though possibly an accurate survey would have revealed some regularity not apparent at first sight.

In the depression in which Kharga oasis lies there are patches of desert, sometimes several hundreds of acres in extent and usually very level, which are coated with coarse pebbles. A large part of these areas is not rippled at all. In other places what appears to be a sort of irregular rippling is seen, the ripples being sometimes as much as 6 inches in height. These ripples as a rule have little lateral extension and are frequently not on a straight line up and down wind. A succession of them that I measured, which were more in line than usual, had the following distances from crest to crest:—

	metres.		metres.
(1)	2·10	(8)	6·70
(2)	1·00	(9)	7·00
(3)	1·30	(10)	1·00
(4)	19·10	(11)	2·50
(5)	5·50	(12)	4·40
(6)	4·50	(13)	22·10
(7)	1·80		

Between numbers (8) and (10) the surface of the ground was noted as being "rough." This caused the ripple number (9) to divide into two parts lying to the east and west respectively of the main line of the ripples. A straight line passing from north to south through the remainder of the series would consequently have crossed this ripple in the break between these two halves. It is possible, assuming the remainder of the series to have formed part of a connected chain, that this divided ripple was really independent of them. In that case number (9) would drop out. Number (8) would measure 13 metres 70 centimetres. (10) would become number (9), and so on.

These ripples are completely covered with pebbles, the sand being almost entirely hidden. It is only on the lee side of the ripple that it is visible. It appears to be only in places where the wind has broken the protective covering of pebbles that it is able to ripple the sand at all. Dunes and ripples such as these are, however, so abnormal in character that they cannot well be classified with other forms.

The difference between dunes and ripples—broadly speaking—I believe to be this: that dunes are piles of sand heaped up and shaped by the wind, while ripples are due to a sort of ruffling action which it has upon a sandy surface.

It was Dr. Cornish, I believe, who first suggested that dunes were waves. His claim to consider them in this light is stated in his book 'Waves of Sand and Snow' as follows: "Periodicity and the transmission of an impulse by the material are the aspects of sea waves which are repeated in the transit of light and sound, although a corrugated surface of progressive inequalities is no part of their character.

"I found, however, that while physicists had applied with great success the ideas got from the aspect of the heaving sea to the study of sound, light, electricity, and other matters, geographers and geologists had not sufficiently availed themselves of these ideas in the study of certain natural inequalities which from their form and movement are as nearly related to sea waves in one way as the pulsations of sound are in another."

That view is one that has never appealed to me. There is absolute identity between sound waves and those of the sea in their regular periodic character and in the fact that in both cases the wave motion is transmitted by an interaction of their particles. But so far as I can see the corresponding resemblance in form and movement between dunes and waves that Dr. Cornish claims to exist has not yet been proved. If it exists at all I think it can only be a very superficial one.

Take first the resemblance in form. What is there in sea waves that can be compared in shape with a crescent dune, which has a cross-section of which the lee side is entirely composed of a straight line? What is there that corresponds to a whale-backed dune? A star-shaped dune? A "sif," that is to say a long ridge of sand running up and down wind such as are found in the Libyan desert, or the rather similar forms to be

found apparently in the deserts of India? These are only a few of the forms that sand dunes take that have no counterpart at all in the forms of water waves.

It is only, I believe, in the case of transverse dunes that there is anything approaching to identity in form. Even then it is confined to transverse dunes in the early stage of their development, for as soon as they reach a certain size they develop a flat face on their lee side which certainly has no parallel in waves of water. Transverse dunes in this early stage, so far as I have seen, are very seldom to be met with. Transverse rippling is of course common enough, and it is possible that it is identical in shape with water ripples, and that transverse dunes are identical in form with some type of sea wave, but this I believe has yet to be proved. But apart from these two forms, every shape that sand dunes take differs so widely from those of water waves that I cannot see that Dr. Cornish can establish his claim as to an identity of form between them.

Then as to the resemblance between the movement of dunes and that of waves: the motion of a dune is due to the erosion of the surface by the wind and not, as in the case of water waves, to the interaction of its particles. If we are to assume that everything that is in motion owing to the attrition of its surface by an external force is a wave, practically the whole of the Earth's crust must be considered as coming under this description, for the action of rain, wind and other external agencies is continually though slowly changing its form.

But in order that Dr. Cornish may justify his contention that dunes should be classed as waves, I do not think it is sufficient for him to show that there is *some* sort of resemblance between them. I think he must also show that dunes, snowdrifts and the other things to which his science of "kumatology" relates resemble waves in those peculiarities which are their distinguishing characteristics, and this I think he fails to do.

"Wave" is unfortunately a word of rather ambiguous meaning. It was, I believe, originally applied to the mound of water that we actually see. Afterwards, when waves began to be scientifically examined, it was also applied to the peculiar movement of the particles that causes the mound. This I believe to be the strict scientific sense of the word. When, for instance, we speak of a "sound-wave" we are not thinking of any particular shape but of the wave motion of the particles that produces the sound phenomena. So I do not think that a mound of any kind, however closely it may happen to resemble a wave of water in other ways, can be classed as a wave, scientifically speaking, unless it is produced by a wave motion.

Dr. Cornish's views on the subject of this wave motion are given in his paper on "Snow-waves and Snowdrifts in Canada" (*Geogr. Journ.*, 20, p. 170). He says, "In waves into which freely drifting powders" (among which he includes sand) "fall, the steep side is on the leeward instead of

upon the windward, and this signifies that the eddy space is never filled up. The whole eddy space is in fact free to move forward, and does so when the snow is drifting and this progression is the wave motion."

I may be entirely mistaken in my view, but I differ from Dr. Cornish in thinking this a wave motion at all. The mere fact that dunes and their eddy spaces are drifting down wind no more constitutes a wave motion to my mind than the drifting of anything else under similar circumstances.

A wave has been defined as "a form of disturbance which travels through a medium, and is due to the parts of the medium performing in succession certain periodic motions about their mean positions" (Watson, *op. cit.*, p. 338). I think that in order to establish the fact that a wave-motion exists it is necessary to show that there is a disturbance passing through the medium, and that the particles of which the waves are composed are "performing in succession a periodic movement"—or, at any rate, a periodic change—"about a mean position." This, I believe, implies that *all* the particles of which the wave is composed must be in simultaneous motion, and that this movement is essentially a rhythmic and regular movement as opposed to a jerky or intermittent one. But so far as I have been able to see there is nothing in the least resembling this in the case of dunes. Only those grains on the actual surface of the dune —an almost negligible percentage of the total mass of sand—are in motion at the same moment, and their movement being dependent upon the action of the wind, which is continually changing in force and direction, is essentially an intermittent and not a periodic one.

The ordinary movement of sand grains over a dune is most irregular. They are blown hither and thither over its surface under the influence of the various winds and eddies that play about a dune; sometimes they rush halfway across it in a few seconds, at other times they lie in a sheltered position unmoved for days at a time; and probably in the majority of cases they end their journey over the dune by being blown off it altogether on to another dune or on to the surrounding desert. It would only be by the rarest coincidence that they would ever repeat their movement a second time. So I cannot see how it could possibly ever happen that all the particles composing a dune could ever perform "a periodic movement about a mean position." Their movement differs so very widely and in such vital characteristics from other and recognized forms of wave motion, that Dr. Cornish's arguments fail to convince me that any form of wave-motion exists in sand or that dunes can rightly be classed as being waves at all.

If I am correct in this view that they are not waves, I trust Dr. Cornish will forgive me if I say that I think it can only be misleading to treat them as though they were. The study of dunes is one that is likely to lead to very practical results for the damage that these moving sandhills do is incalculable. If the view that these dunes are waves when they are not waves were allowed to get established not only would inquiry into dune

phenomena be started along the wrong lines, but an engineer at a critical time might be induced to embark on an elaborate scheme of sand defence on the assumption that dunes would behave as waves and so could be deflected from a wall or dealt with by setting up interference between them, and the failure of his scheme might entail serious consequences.

I believe it possible, however, that in some cases wave motion may have an influence in modelling sand; but if so the waves are waves in the air and not in the sand itself. When an obstruction to the wind such as a large stone is lying upon a level sandy surface, the sand on its lee side is sometimes thrown up into ridges, quite distinct from the ripples surrounding them and apparently caused by the presence of the obstruction to the current of air.

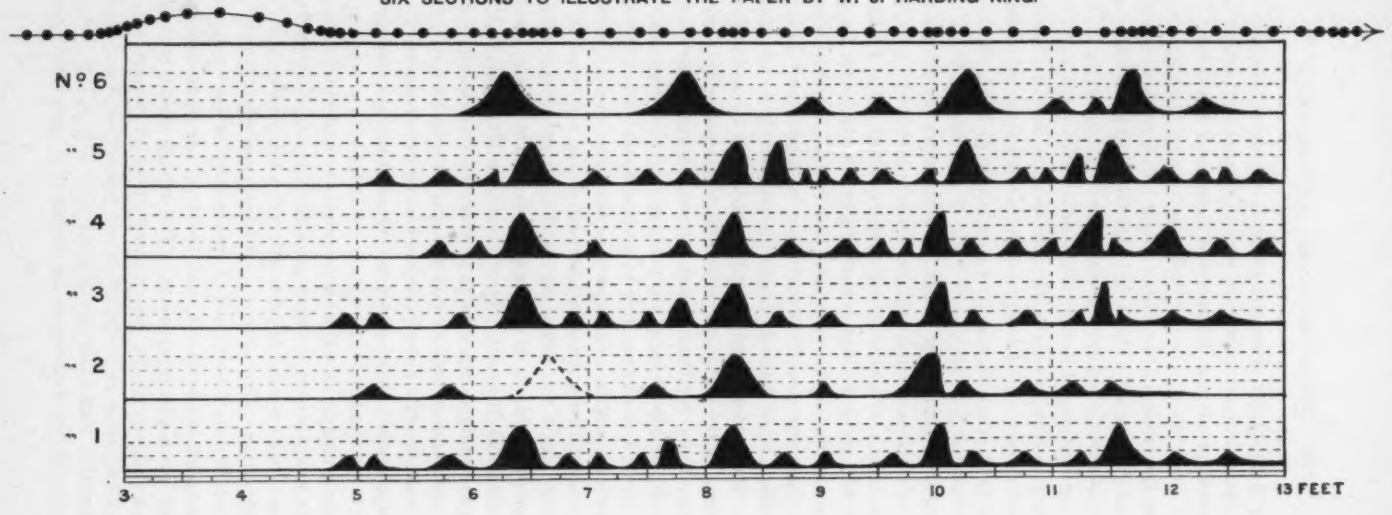
I have seen what seems to me to be the same phenomenon in the case of transverse dunes. Some large sewage disposal works in connection with the drainage of Cairo have recently been constructed at El Khanka. The various tanks and buildings in connection with the works lie in the north-east corner of the sewage farm, which at this point is overhung by a large transverse dune running from north-west to south-east. One of the engineers working at El Khanka becoming anxious as to this dune asked me to come over to look at it. The dune was said to oscillate slightly under the influence of the prevailing north-east and south-west winds, but, so far as was known, the resultant movement was inappreciable. Several parallel dunes could be seen lying to the north-east of this large dune, the nearest of these being a small low dune which had come into existence during the building of the works. There were at that time no signs of a dune to the south-west of the large dune and between it and the farm.

A year later I was asked by the Controller-General of the works to report on these dunes, in collaboration with Dr. Hume, the head of the Cairo Geological Museum. On this second visit the small new dune, lying to the north-east of the large one, was noticeably larger than on my first visit, and an entirely new dune, in close proximity to some of the smaller buildings of the works, seemed to be developing to the south-west of the large dune, which by obstructing the wind presumably had caused the sand to accumulate.

When a stream of water pours over a rock it frequently sets up stationary waves on the downstream side of it; so it seemed possible that somewhat similar waves might be set up in the air owing to the presence of an obstruction. To test this view I had a wooden trough made 13 feet 1 inch long, 8 inches wide, and 9½ inches deep in the interior. The wood warped somewhat in the dry heat, but I do not think this can have had any effect upon the experiments. The trough could be turned to meet any serious change in the direction of the wind during the experiments, and since the sides of it cut off minor temporary flows in direction the wind invariably blew straight along it.

The trough was first placed on the top of a dune, and after the bottom

SIX SECTIONS TO ILLUSTRATE THE PAPER BY W. J. HARDING KING.



of it had been covered with a thin layer of sand taken off the dune on which it stood, it was turned so that the wind could blow along it. The wind blowing at the time was a fairly strong one and rather gusty but steady in direction. As soon as the wind began to blow over it the sand rapidly developed rippling in the ordinary way, by becoming first covered with small pits that gradually coalesced to form ripples; these then increased in size till they reached their maximum development of 4 inches, which a measurement of four chains of ten ripples each in different parts of the top of the dune had shown to be the average ripple length. From this it was clear that the sand inside the trough rippled in the same way as that on the dune outside it. Owing to want of friction against the planed wood the sand gradually blew out at the lee end of the trough, first forming bare patches at the bottom in the hollows between the ripples. The trough was then closed at the windward end and the bottom was again covered with the same kind of sand as in the first experiment. After being put into the trough the sand was levelled by reflecting a ray of sunlight along its surface as shown in the plate; the ridges were smoothed over and the hollows were filled in by sifting sand into them by hand. Other experiments however showed that minor inequalities invariably disappeared soon after the wind had begun to act, the ridges being blown away and the hollows filled up, unless they happened to be in a position corresponding to that of one of the chain of ripples that eventually formed. Three feet from the windward end a partition 1 inch high above the bottom of the trough was then inserted, consisting of a piece of stiff folded paper banked up on both sides by sand. In a few minutes the down draught on the lee side of the partition cut down to the bottom of the sand at about 18 inches to leeward of it so as to expose the wood. The remainder of the sand became gradually covered with the same 4-inch rippling as before, in which I could detect no change. I then inserted a 3-inch partition instead of the one previously used which appeared to make no difference except that the down draught struck down rather farther to leeward; the exact position where it met the sand could not be seen with any accuracy as it laid bare several inches of the bottom of the trough.

In both of these experiments however the sand blew out of the trough so quickly that the bottom began to show very soon after the 4-inch rippling had formed. As I expected any unusual rippling set up by a stationary wave to take some time to form after the partition had been put in, this rapid emptying of the trough seemed likely to render the experiment useless. Deepening the sand beyond a certain point made the trough too heavy to turn without jerking it and so upsetting the rippling, and various expedients that I tried failed to remedy the defect. At last, however, I hit upon the plan of sprinkling some coarser grains on the surface of the fine dune sand in the trough. The sand was not covered by them, about two-thirds of the surface being left exposed. This had the desired effect.

The down draught beyond the partition still had sufficient force to expose the wooden bottom, only a few of the larger grains remaining unmoved; the 4-inch rippling still showed though it became more irregular and indistinct. But it soon became clear that a series of larger ripples were developing quite independently of the smaller ones.

The position of the different ripples is shown in the sections (p. 196), which were taken at different times—usually with about an hour's interval between them—during the progress of the experiment. No attempt has been made in these sections to show the absolute height of the different ripples, as measurements of such small elevations without special appliances are not very reliable. The sizes were divided into three groups: the smallest which were so small and indistinct as to be sometimes hardly distinguishable; the largest which were very pronounced and could not possibly have been confused with the smallest; and an intermediate size that could not always be classed with certainty with either of the other two. The height of the ripples was estimated by means of a ray of reflected light which acted as a straight-edge. The scale at the bottom of the sections gives distances from the windward end of the trough, the partition being inserted at 3 feet. The long dotted arrow at the top shows the direction of the wind and its approximate path after surmounting the partition, which is shown to scale on the left side. The dots on the arrow give the positions of the supposed condensations and rarefactions of the wave motion set up in the air by the partition.

The sand was completely emptied from the trough after the first section had been taken and was put in again for the second experiment. This was done in order to make sure that the positions of the rippling were not due to accidental inequalities in the surface of the sand which had been overlooked or to an unequal distribution of the larger grains on its surface. The coincidence of the position of the larger ripples in the first and second sections showed so clearly that this was not the case that the third, fourth, and fifth sections were taken without again emptying the trough. The plank forming the lid of the trough was sometimes put on during the exposure of the sand to the wind, but it seemed to have no effect beyond perhaps making the rippling rather sharper. Owing to the warping the plank did not fit exactly to the top of the trough.

In the second section it will be noticed that the large ripple at the leeward end does not appear. It may have been that it had not had time to develop, but it was more probably due to the fact that the end of the tube was entirely open while in the other cases an obstruction one inch in height, that is rather more than the depth of the sand, was inserted to prevent the wind from blowing the sand out at the end. The presence of this obstruction caused the sand to bank up here to some extent and so raised its level at this point. The most windward ripple in this section is shown by a dotted line, as although it was seen to exist, the rule which I was using to take the measurements fell on it before its exact position

could be fixed. It will be seen that it reformed at about the same spot before the next section was taken. According to the distance between the large ripples another ripple of this type should have formed to windward of the first one. But the down draught from the partition scoured the bottom of the trough at this spot and so prevented it from forming. I have noticed the same peculiarity in the case of rippling under the lee of a stone. There was a marked tendency for the larger sand grains to collect on the crests of the larger ripples, and to a lesser extent the same phenomenon was to be observed in the case of the smaller ones too.

To make sure that the rippling observed was not due to any motion of the air set up for instance by some obstruction to windward that had been overlooked, or to the nature of the sand put into the trough, it was taken for the last experiment 6 miles away and set up on a platform 2 feet high above the surrounding ground; the sand used was collected from some neighbouring dunes and was put into the trough in the same manner as in the preceding experiments. This fine sand was rather finer and the coarse grains rather coarser than those that had been previously used.

The trough was first opened to the wind at about 1.30 p.m. and it was left exposed for about four hours. Throughout the whole time a high wind—almost a sandstorm—was blowing. At the end of the time the wind had commenced to lay bare the bottom of the trough and the ripples occupied the positions shown in section No. 6. The place chosen for this experiment was one where the sand was unrippled for a long distance to windward, one object of the experiment being to ascertain whether the 4-inch rippling which appeared in the other experiments was due to the fact that the air passing over the ripples of the dune upon which the trough was placed entered it already vibrating with a 4-inch wave length.

On this point the results were inconclusive. For some unexplained reason—possibly owing to the greater disproportion between the sizes of the two kinds of sand used—the small rippling never seemed to develop properly. The large rippling was more irregular and rather more indistinct than in the other experiments. The large grains of sand used in all these experiments were taken from large ripples under the lee of a natural obstruction, the finer sand being taken from a dune. A noticeable peculiarity in all the ripples formed under the lee of an obstacle is the large grains on the crests, which are sometimes entirely covered by them.

It will be seen that in all these sections the larger ripples remain stationary or only oscillate slightly, while the smaller ones continually change their positions as they progress to windward. I have noticed the same peculiarity in the large ripples formed under the lee of a stone. They are not absolutely stationary as they creep slowly down wind. But this motion is counteracted by reverse winds and, I think, by the fact that, though the ripple may advance, the wave of air remains stationary, and consequently tends to deposit the sand grains on the windward side

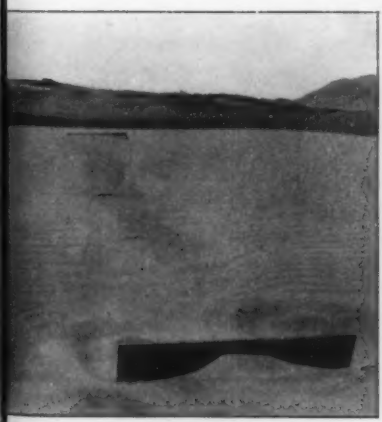
causing an extension to windward, which to some extent compensates for the ripples' leeward motion

These chains of rippling are usually to be seen on the flank of a dune. Such a position is most favourable to their development, for the wind always contours round these slopes, and consequently even a considerable change in the direction of the wind would have little or no effect upon the course of the air current round these flanks. The small ripples that appeared in the trough I believe to be the normal rippling of the sand, while the larger ones were, I think, due to some movement of the air set up by the partition. This view was accidentally confirmed in rather a curious manner. When I first scattered the large grains on the sand in the trough I also laid some to the same extent on a strip of the dune close by to make certain that any unusual formation in the rippling of the trough was not due to the addition of this coarser sand but to the presence of the partition. The only effect these coarse grains had upon the normal rippling of the dune was to make them much more indistinct and almost to obliterate them.

The strip of dune that I covered in this way lay immediately under the telephone wire that runs along the railway to its terminus in Kharga village. During the course of the day a party of men came along the railway overhauling the telegraph line, and as I was afraid that they might trample on the sand-covered patch I set a piece of board edgeways into the sand at each end of it and asked them to keep outside them. The wind blew strongly during the next night, and when I visited the dune about 9 a.m. I found that two large ripples—perfectly distinct from the other rippling on the dune—had formed at 57 and 102 inches respectively from the front edge of the board, which quite accidentally I had inserted in the sand exactly at right angles to the wind. During the course of the morning a fresh ridge formed 18 inches from the board. This crest however was more in the nature of a mound than a ripple and was most probably due to the wind cutting round the ends of the board and piling the sand up in front of it. At 11 a.m. on re-measuring the position of the ripples I found that they had slightly changed their positions to 58 and 99 inches respectively, so that one ripple had advanced 1 inch while the other had retreated 3 inches. At 11.45 a.m. on testing the sand with a ray from the mirror I found a slight rise in its surface at 129 inches, which, though it was not noticeable until tested in this way, was clearly not part of the normal contour of the dune and may possibly have been another ripple in process of formation. Both it and the ridge at 18 inches, however, differed from the other two ripples in a very noticeable feature. In the first two ripples the large grains had collected on their crest, which they had not done in either of the other two cases. As this new ripple did not appear to be developing and the wind showed signs of failing, after a time I removed the board and smoothed over the mound of sand that had collected round it to the

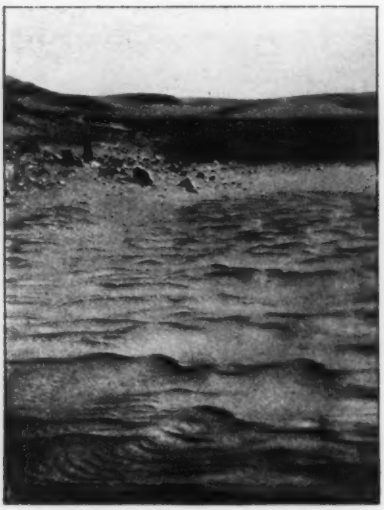
LIGHT REFLECTED ON TO RIPPLING IN TROUGH.

LINE OF RIPPLES CAUSED BY STONE.

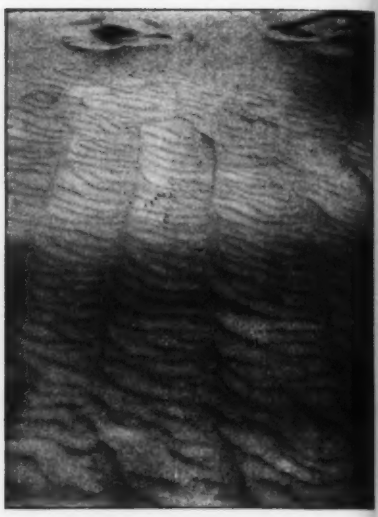


TWO RIPPLES CAUSED BY BOARD.

CONDENSATIONS AND RAREFACTION IN STREAM OF AIR.

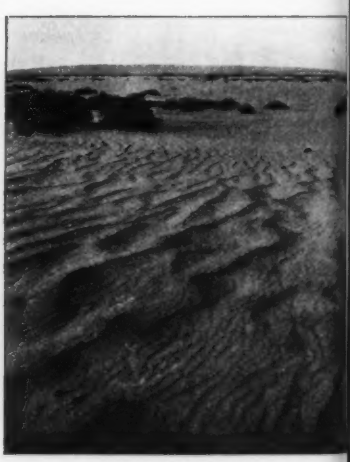


HEAVY RIPPLING IN COL BETWEEN TWO DUNES.



CROSSING RIPPLES.

CLAY DUNE.



HARMONIC RIPPLING.

normal contour of the dune, with the result that the large ripples gradually disappeared.

Now in Kundt's experiment, where a piston was caused to vibrate longitudinally in the mouth of a tube closed at the opposite end and containing a small quantity of light powder, waves of air set up by the vibration of the piston were reflected from the closed end so as to cause a series of stationary waves in the tube; the result being that the powder was collected into heaps under the loops of the waves. Presumably sand would be deposited in the same manner if a series of waves of compression and dilation could be brought to rest in the open air relatively to the surface of the ground.

When a London street is undergoing repairs and one half of it is railed off for that purpose the stream of traffic passing along the street crowds together on passing the obstruction. Beyond it the vehicles are much more scattered and are moving with much greater velocity, owing to the fact that when they have got through the block they have much greater freedom of movement. Much the same thing must, I think, occur when a stream of air particles has to pass over an obstruction, for not only would they be crowded together in their effort to get past it but they would also have to force up the overlying strata in order to find a way over it. This would be especially noticeable during the gusts. Consequently a certain amount of compression of the particles and a retardation in their velocity seem inevitable. But when there is a compression of the particles in one part of a stream of air I think there must be a condensation and that it must be followed by a dilation immediately beyond, so that as soon as the air particles have passed the obstruction it would seem that they would rush forward into the low-pressure area beyond it at more than the normal speed of the air-stream of which they formed part. Now a condensation in air followed by a rarefaction constitutes a wave; and where there is one wave I think that the interaction of the particles must repeat itself to form a series of waves until it becomes exhausted.

At first sight it would appear that ripples under the lee of an obstruction must be due to stationary waves in the stream of air analogous to standing waves in a stream of water—the waves being rendered stationary by the fact that the position of the first node is fixed, relatively to the ground, by being produced by a stationary object. Any explanation of these experiments requires of course a mathematical proof, which I regret to say I am unable to supply, and the theory of the stationary wave is open to some objections that may be fatal to it.

In the first place the sand collects under what should be the nodes of the waves and not as would appear probable from Kundt's experiments under the loops. The conditions, however, are not quite the same in the two experiments: in Kundt's experiment the powder that formed the heaps was lying stationary at the bottom of the tube until it was set in

motion by the vibration of the air, while in my experiments the sand was also subject to the direct action of the wind, and the sand that blew into the tube was already in motion as it was flying down with the wind, so it is only reasonable to expect the heaps to collect at some distance to windward of the loops of the air waves.

Another difficulty occurs owing to the fact that in order for a wave to "stand" it is necessary that it should be moving upstream with the same velocity as the stream itself is moving in the opposite direction, with regard, that is, to exterior objects. So that in this case the wind would have to be blowing with the same velocity as a wave of compression and dilation—that is to say, with the velocity of sound—which of course is far greater than that of any wind. It is doubtful, however, whether the ordinary equation for estimating the velocity of a wave of this type would apply in this case, owing to the fact that the air of which the wave is composed is frequently heavily loaded with sand which would be very likely to reduce the velocity of the wave, as the sand grains would get in the way of the vibrating air particles. Another fact which might cause the wave to behave in an abnormal manner is the fact that the wind is continually varying in velocity, so that there is the possibility of a "forced" stationary wave to be considered which might fulfil the required conditions.

As a final experiment I allowed a cloud of smoke to blow during a high wind over a board set at right angles to it, to see whether the condensations and rarefactions constituting the wave could be made visible. The photograph that I took shows what appears to be a wave of this description. The first condensation appears on, or rather just beyond, the top edge of the board. This is followed by a less dense portion of the smoke which terminates in a second condensation.

There is another form of rippling that I think may perhaps be due to a wave motion though possibly one of a different character. When two crescent dunes join together to form a cluster the col between them, which runs up and down wind, is often covered with very large ripples, suggesting the rough water to be seen when two streams unite to form a larger one, the two streams being apparently represented by the currents of air contouring round the flanks of the two dunes. I have not, however, carefully examined this form of rippling. Neither this nor the series of ripples developed under the lee of an obstacle are ripples of normal type, which I believe to be formed in a different manner.

In her interesting paper "On the Origin and Growth of Ripple Mark" (*Proceedings Roy. Soc.*, Series A, vol. **84**, p. 288), Mrs. Ayrton showed by oscillating water in a trough, the bottom of which was covered with sand, that the grains collected into a ridge in the centre of the trough, because there was "a steady periodic advance from places where the horizontal velocity of the water is least to places where it is greatest, each oscillation leaving the grains nearer to their goal than it found them," the "goal" mentioned being of course the centre of the trough where the ripple

formed. This is also presumably what happened in Kundt's experiment. Mrs. Ayrton suggests in her paper that many water-formed sand phenomena, as well as desert sand dunes, may be the result of stationary waves. So far as sand dunes are concerned, I agree that in many cases a stationary wave of air may play some part in their formation, though I doubt if it is a very important one. She also states her belief that eolian ripples may be due to vortices such as she describes as developing in the water on the down-stream side of the ripples in her trough. I do not think this is so in the case of the ripples I have described under the lee of a stone or in the col between two dunes—but these of course are abnormal forms. In the case, however, of the ordinary rippling seen on a dune and on level expanses of sand I think it probable that eddies play a very important part in their development.

There have been many theories to account for eolian rippling. Baschin states his view thus :—"The true cause which produces regular wave-like forms on a flat surface of loose sand and thereby creates the foundation for the regularity of further sandhills is the tendency towards the formation of a Helmholtz wave-surface" (*Zs. Ges. Erdk. Berlin*, 34, p. 419). This wave-surface he describes as follows :—"So long as a still layer of air is found over a still mass of water, equilibrium is preserved. This stability is immediately disturbed as soon as the air is put into motion. The friction of the air on the water surface has this effect, that the velocity of the air current decreases from top to bottom, and the volume of air that flows in through an equally large cross-section must become less towards the bottom. Now a layer that flows with greater rapidity than the one under it exercises a sucking influence; that is to say, the pressure which the air exercises on the surface of the water is lessened, the condition of equilibrium is no longer fulfilled, as the pressure from below is greater than from above, the water will therefore spread upwards, and in this way a wave movement is introduced" (Baschin, *op. cit.*, p. 411).

Dr. Cornish's view is that rippling takes place when the eddy under the lee of a large grain has sufficient force to move a smaller one. Observation of eddies of this kind is extremely difficult owing to their small size and the invisibility of the air currents. But I have often noticed, when watching the sand grains hopping over a dune, that some of them appear to get up from the ground at a very obtuse angle, which would correspond well with the tossing action of such an eddy as he suggests. This, however, may also be due to another cause.

I agree with Mrs. Ayrton and Dr. Cornish in thinking that there may be an eddy *when rippling has once been formed*, but I do not think the pitting that first appears when the wind commences to blow over smooth sand, and that precedes the actual rippling, is due entirely to this cause. Its approximately circular form, the fact that it is a depression and not an elevation, and its irregular distribution, tell against its being due to a wave motion depositing sand, as it did in Mrs. Ayrton's and Kundt's

experiments. Dr. Cornish's theory that these pits are first formed by an eddy under the lee of a large grain also fails to convince me for several reasons. I think it fails to account for the well-known fact that the direction of the rippling changes with a change in the direction of the wind; for suppose that the wind commences to blow upon an unrippled expanse of sand—say from the north: this we know will produce ripples running east and west. But now suppose the wind fails and a wind from the east springs up. It is difficult to see how by this theory the north and south ripples that we know will be produced can be formed, for according to this view all the large grains must be upon the east and west ripples formed by the north wind, so there can be no large grains in the troughs to produce the rippling that we always find there as a first result of a change of wind.

Then, too, it is essential for the truth of this theory that the sand should consist of grains of different sizes, and it would appear that the greater the difference in size the more pronounced would be the tendency to ripple, for the larger and consequently the stronger would be the eddy under the lee of the large grains. A considerable disproportion in the size of the grains, instead of producing rippling has exactly the opposite effect, so far as my experience goes. The coarse sand I laid on the dune by the trough almost entirely effaced the ordinary ripples. The large level areas covered with sand which figure so conspicuously in the maps of the North African deserts under the name of "Serir" are covered with fine sand with a sprinkling of much coarser grains, and are almost entirely unrippled.

I suggest as an alternative a theory which, while it is close to Dr. Cornish's, is not identical. I believe that when the wind blows over an unrippled surface of sand, or over a rippled surface from a new direction, it first moves those sand grains which from their size, shape, position, or other cause are in the condition of most unstable equilibrium. The removal of these grains in many cases would withdraw support from some of those to windward of them and expose some of those to leeward of them to a greater action of the wind—both of these would consequently be more likely to be moved. In this way the first pits would be formed.

It must be remembered that while a sand grain—say, of a long narrow shape with its longer axis pointing up and down wind and supported by other grains to leeward of it—may be in a state of very stable equilibrium while a wind from one direction is blowing, it might be very easily moved by a wind from another quarter and so would easily lend itself to a change in the direction of the rippling. Now next to the ground there is a layer of air which moves considerably more slowly than the layers above it, especially when owing to a strong wind it is loaded with sand (Olsson-Seffer in *Journ. Geol.*, 1908). We also know that this layer only increases its speed at a very slow rate with an increase in the velocity of

the layer next above it.* Consequently, when the wind is blowing this lowest layer is strongly acted upon from above by a tangential force in the direction of the wind and below by a second tangential force in the opposite direction. The result, especially in the gusts, must be a tendency to set up vortices with a horizontal axis to act as a kind of ball bearings to allow the upper and more rapidly moving layer of air to pass along more easily. These eddies would not only form most readily in the pits, but could not easily be dislodged from them, consequently they would tend to be stationary and to form and reform in the same positions.

The tendency to move in a sinusoidal path that fluids show when travelling at a high velocity has often been noticed, and is frequently very marked when a high wind is blowing over a sand dune. The sinuosities in this case are only noticeable in a horizontal direction, but it is possible that the formation of small friction eddies such as I have described might be sufficient to set up a movement of this kind in a vertical direction as well, and in that case the motion might have some effect in shaping the ripples. The size of the sinuosities would presumably be dependent on that of the eddies beneath them, and so would fit in with the size of the rippling. It is possible, too, that the ripples when once they had been formed might offer sufficient obstruction to the wind to set up a series of stationary waves, which also would assist in their development and help to regulate the interval between them. The development of the ripples from the first pits would be by the lateral expansion of the eddies and troughs and the other stages, so admirably described by Dr. Cornish in his paper "On the Formation of Sand Dunes" (*Geogr. Journ.*, vol. 9, pp. 286 *et seq.*). The reason why ordinary sand ripples, while "serir" hardly ever does, I believe to be that the large grains scattered over the surface of the finer sand of the "serir" are sufficiently close together and are of sufficient size to break up the small eddies and so prevent them from moving the sand. The movement of the sand on these level plains is noticeably less than among the dunes.

It has often been noticed that certain winds have a greater capacity for moving sand than others of the same strength. To a certain extent I think this depends upon the direction of the wind with regard to the one that preceded it. If a wind, for instance, blows from the north and so forms ripples running east and west, and then an equally strong wind follows from the east so as to blow along the troughs of the ripples, there will be no hollows for the grains to shelter in until fresh ripples have been formed, and the sand-transporting power of this wind for a time would be very great. The presence of moisture, too, would affect the movement of the sand. I am not sure whether moisture by itself, unless it were excessive, would make any serious difference, but it would I think have a very considerable indirect effect by altering the electrical conditions.

* J. A. Udder, 'The Mechanical Composition of Wind Deposits,' Augustana Library Publications,' vol. 1, p. 24. 1898.

The mobility of electrified sand is well known and may perhaps account for the steep angle at which sand appears sometimes to get up off the ground. At Ismailia I tested the electrical conditions of the sand blown off a dune. I should like to take this opportunity of acknowledging my indebtedness to Dr. Ball and Mr. H. E. Hurst of the Egyptian Survey Department, who both gave me all possible assistance and advice in carrying out these experiments. Dr. Ball, in addition, most kindly placed at my disposal the electrometer I used for the purpose. I had a collecting box made, consisting of a cigarette tin completely insulated inside a biscuit tin, the object of the outer casing being to cut off any atmospheric electricity. A slot was cut near the top of one side of the outer case with a corresponding opening in the inner one. The receiver was placed in the sand at the top of the flat face on the lee side of the dune in such a position that when the sand was blown off the dune as much of it as possible should be blown through the slot into the inner case. When a sufficient quantity had been collected the receiver was carried to the electrometer in a tent a few yards away, and the charge on the sand was taken. The electrometer was discharged by sealing-wax rubbed on flannel, so the charge was positive.

Owing however to a defect in the form of the receiver the results obtained are misleading, for some of the sand grains were discharged by striking against the upper part of the outer tin and then, as they fell, were blown through the slot into the inner box. On the other hand some grains were blown through the outer slot which struck and discharged themselves against the outside of the inner tin without entering it, then fell into the bottom of the outer tin and so were not weighed. The most I can claim for these experiments is that they show that sand blown off a dune is apparently very heavily charged with electricity—in one case the electrometer showed 980 volts on 30 drachms of sand—and that that charge is positive. It is probably due to the friction of the sand against the dune, for it is hardly likely that it could have picked up such a heavy charge from the atmosphere. It would have been better if the electrical condition of the air had been taken at the same time. To be complete, I think a large number of these experiments would be required as they should be taken under different conditions of wind velocity, moisture, temperature and atmospherical electricity, and this would require rather elaborate apparatus and very considerable time.

Electrical phenomena in connection with sandstorms are often very marked. One evening after an unusually bad sandstorm in the Libyan desert, when I picked up a woollen burnus and shook it to get rid of the sand, it blazed literally all over with sparks, and when I put my finger near my blankets I drew a spark that I could very faintly feel. I have heard, on rather doubtful authority, of a brush discharge about 6 inches long on the ears of a camel during an unusually bad sandstorm from the south. When this hot south wind is blowing the air is probably unusually

dry—if comparisons in dryness can be made in a climate where minus humidity has several times been recorded—and this of course would contribute to electrical phenomena.

It is possible that electricity from these storms may account for the high percentage of ozone that Zittel found in the air of the Libyan desert, which was 7·3 as compared with 4·9 in the oases.

The sand-transporting power of the wind increases enormously with an increase in its velocity. Olsson-Seffer states (*Journ. Geol.*, 1908)—I do not know on what authority—that it "varies more nearly in approximation to its erosive force than to its lifting force. With changes in velocities the latter varies as the sixth power, while the erosive force varies as the square."

One of the most interesting phenomena in connection with dunes is the curious power they appear to have for collecting all the sand in the neighbourhood. It is not an uncommon thing to see an isolated dune standing in the middle of a sandless plain with no ripples or dunes to be seen anywhere near it. When this is considered it seems very curious that all the sand from an enormous area should be swept up, as it were, into such a sharply defined heap. If the dune were composed of fine dust such as is to be seen upon a high-road, the first strong wind would scatter the grains all over the desert. The reason that sand is not scattered in this way is, I think, due to the fact that it ripples while dust does not. Once a sand grain drops into the trough of a ripple it is sheltered from the wind and unless moved by an eddy eventually becomes covered up by the other grains that follow it. These ripple troughs, being placed at right angles to the wind offer an ideal shelter for such very small bodies as sand grains.

But if a grain is blown off the extreme edge of the dune so as to fall clear of it and the eddies round it, it is whirled away across the desert. While a grain is on a dune there is a ripple trough for it to shelter in every few inches of its progress, but in the open desert the sheltered places are much further apart, consequently once it has left the dune the grain will travel very much further before it comes to rest. The shelter it then reaches may be one which will only protect it from a wind blowing from one particular direction, while, if it had remained on the dune, a change of wind would very soon have been followed by a change in the direction of the rippling in which the grain could take shelter again; so in this way the ripples on a dune protect it to a great extent from the action of the wind which otherwise would rapidly reduce its bulk.

After Mr. Harding King read the paper a discussion followed.

Dr. OWENS: We are all very much obliged to Mr. Harding King for the excellent paper he has brought before us; I hope it will provoke an interesting discussion.

There is sometimes a tendency to compare sand with a liquid, and this Mr. Harding King has very rightly criticized. In sand you have one quality at

least which is entirely absent from liquids, that is the property of adhesion between the grains as distinct from fluid friction. This property results in sand having an "inclination of repose"; so that if you pour out sand into a heap it will pile up at a definite angle depending upon various qualities, but chiefly upon this adhesion between the surfaces of the grains in contact. The slope of the surface will be such as to produce equilibrium between the pull of gravity down the slope and the resistance to movement of the particles due to adhesion to their beds.

As to the comparison of the motion of sand waves with water waves, this is very liable to cause confusion; I can myself see little likeness except in the mere form of the waves.

Reference is made to experiments with a trough; these are very interesting, and I think all questions connected with the movement of sand by air or water should be investigated experimentally when possible; because the movements are so complex, and the results so unlooked for sometimes, that one is liable to arrive at conclusions which are utterly wrong unless they are put to the test of experiment. As illustrating this, I may mention that one of the things which I found in experimenting on the rate of deposition of solids through water was that bodies falling through water set themselves in such a position as to offer the greatest possible resistance to their motion through the water. That is quite the contrary to what might be expected at first sight.

Another interesting point referred to in the paper was the failure of fine sand to form ripples in the trough. I merely throw out the suggestion that there may be a critical velocity of the wind above which it will fail to ripple and below which it will ripple sand, provided the velocity is sufficient to move it; perhaps this critical velocity varies with the size of grain. I mention this because I found that in the formation of sand ripples under water there is such a critical velocity. Ordinary sand ripples of the type referred to in this paper will form in currents up to about 2½ feet per second; just before that velocity is reached the ripples begin to get very uncertain in outline; and when 2½ feet per second is reached they are all swept away and an entirely different form of movement sets in.

The late Sir George Darwin wrote a most interesting paper on ripples; in it he described experiments on their formation by oscillating currents and showed clearly that the ripples were due to vortices in the water (*Proc. Royal Society*, vol. **36** (1884), pp. 18-43).

Another point raised by Mr. Harding King is the crossing of two sets of ripples. I have observed the same thing in connection with ripples formed under water; in fact, one of the things which first led me to believe that ripples could be formed by a uniform current was a fact that I observed on sandy foreshores, where as a rule you find that the ripples left when the tide recedes run parallel to the coast-line. In some cases where a pool of water is left on the landward side of a bar of sand these original ripples are found perfectly intact in the bottom of the pool, which protects them from the destructive action of the breaking waves as the tide recedes. Very often, however, the original ripples are crossed by a new set as you approach the outlet from the pool; these begin near the outlet as notches in the crests of the old ripples, and finally the old ripples are entirely replaced by the new set running at right angles to the original direction, and formed by the current issuing from the pool.

Mr. HINKS: It is notoriously difficult to form an opinion about many of these questions. I was thinking as Mr. Harding King was speaking of the

question which has been treated by some very eminent astronomers of the formation of the "Milky Way." At first sight there would appear to be nothing less probable than there should be any relation in theory between the motions of a number of stars enormously far apart, only very occasionally coming within range of one another, colliding perhaps almost infinitely rarely; and the motion of the molecules of a gas in which collisions are extremely frequent. But yet it has been shown by George Darwin that if you take a broad enough view and a long enough time, the theory of motions of stars and of a gas is essentially very much the same thing. Therefore it struck me that it must be rash to say *à priori* that the motions of these sand dunes are not perhaps wave motions as Dr. Cornish has made out. But at the same time, when one looks at the thing in detail, I am bound to agree with Mr. Harding King that there is a great want of the essential features of wave motion in the motion of dunes. I take it he distinguishes considerably between the motion of the dune and the motion of the ripple. In the motion of dunes you have nothing to do with waves at all. Motions of ripples may be connected with waves but waves in the air, not in the sand. I intended to ask whether anything has been done about the actual vibration of the sand. Sand is a very curious material indeed, as you will all remember who have read a little book by Osborne Reynolds. I shall never forget his Rede lecture, which was called "An inversion of our ideas concerning the Universe," and consisted of a series of experiments that appeared to be miraculous with a long explanation of them which nobody could understand. Incidentally the distinguished lecturer brought out some of the many extraordinary properties of sand, such for instance as its liability to expand under pressure. That explains how it is that when you step on wet sand on the seashore there is a dry ring round your foot immediately. Many other curious properties sand has. I should like to ask whether there is any possibility that a material like sand can have a series of vibrations propagated along it in the material sand itself, and if so whether that may have some relation to the length of the ripples. That is probably quite a wild idea. The existence of musical sands shows that the material can vibrate in mass. Is it possible that the ripples are in any way connected with the nodes, as the sand collects along the lines of nodes in Culadin's well-known experiment? At any rate Mr. Harding King's experiments are very interesting and instructive, apart altogether from their value as a criticism of Dr. Cornish's theory. It seems to me that he has started fresh opportunities for theorizing in the experiments which he admits he has not completely explained to himself. One is tempted to believe that that theory of forced vibrations in the air responsible for this must be the true one; but it is not easy to say how those forced vibrations are created. I do not know if he made quite clear the impossibility of its being a stationary air wave of the ordinary kind. A stationary wave must be stationary with regard to the earth, but must be travelling with the velocity of sound in the air; and of course the wind does not travel with anything like the velocity of sound. I think I have nothing more to say but to congratulate Mr. Harding King upon the clearness with which he has related the very interesting experiments he made for a number of seasons in Egypt, and to express the hope he may in future years be able to add a great deal to the subject which he has begun with so much fertility of invention.

THE PORTUGUESE AND THEIR EARLY KNOWLEDGE OF CENTRAL AFRICAN GEOGRAPHY.

Sir Harry H. Johnston, G.C.M.G., K.C.B.

THERE appeared in the January number of the *Geographical Journal* some remarks of Sir Francis Fox, pursuant to Sir Charles Metcalfe's address on "Railway Developments in Africa." They were to the effect that there exists in the keeping of the Library at Capetown a remarkable map, presumably of Dutch draughtsmanship in the seventeenth century, showing the extent of Portuguese knowledge of the African interior in those times. Sir Henry Stanley is supposed to have remarked on seeing this map that had he known of its existence he might have been spared the hardships attendant on his revelation of the Congo mystery. I cannot help thinking he must have said this sardonically and with a twinkle in his eye, for I am practically certain that the map referred to by Sir Francis Fox is nothing more than the usual labyrinth of rivers and lakes communicating with one another to an extent which, even with the knowledge of the connection between the Orinoco and the Amazon systems and between that of the Benue and the Shari, nevertheless staggers the imagination as never possible at any time in the geological history of Africa. I remember vaguely having seen the map to which Sir Francis Fox alludes on a visit to the Capetown Library many years ago. I cannot say, then, that it struck me as being any different from the type of Dutch maps of Africa published in the second half of the seventeenth century. I have one of these maps at home dated 1676. It differs slightly from an earlier version of the same map in the first edition of the same Dutch book published in 1627. In it the geography of Central and Southern Africa is detailed enough, but is of course utterly false. The Nile is shown rising from twin lakes of large size which should be situated somewhere in the North Nyasa and Central Congoland regions, and from these lakes flow equally most of the rivers of south-west and south-east Africa. The geographical names attached to the Nile lakes and to the branches of the Nile were shown by the late E. G. Ravenstein long ago to be simply names of Abyssinian geography; in short, Mr. Ernest Ravenstein, with the most acute criticism and well-sustained research, long ago placed on a right footing the extent of Portuguese recorded knowledge of African geography. We all know that the source and, roughly speaking, the course of the Blue Nile and the main features of Abyssinian and Ethiopian geography were made known to the Portuguese world by the missionaries Francisco Alvares, Pedro Paez, and Jeronimo Lobo, in the last half of the sixteenth and the first half of the seventeenth centuries, by Paez and Lobo especially. The information they collected found its way to the industrious Dutch seekers after knowledge, and by them was grossly

exaggerated as regards area covered, and was mixed up with the century by century exaggerations of Claudius Ptolemaeus' theories regarding the origin of the Nile.

G. McCall Theal has shown us conclusively by his publication of the geographical documents in the *Torre do Tombo* that in the second half of the sixteenth century the Portuguese possessed very shrewd and generally accurate notions as regards the extent and course of the Zambezi River. But no assertion in these documents is made that this information as regards the innermost parts of Central Africa was derived from Portuguese exploration, but rather from information given by intelligent natives. But if they had drawn maps at that time (and there is no record of their having done so) they would certainly have been able to give a fairly accurate idea of the sources and course of the Zambezi from the eastern limits of Angola to the Indian Ocean. I am not aware, however, of the existence of any map showing the putting down of this knowledge on paper. Just when the Portuguese might have been ready to do so there occurred one of the most disastrous events in the history of Central Africa: the overflowing of the Jagas. The Jagas (the word is a nickname meaning "headman" or "chief") have been identified with the modern Va-kioko, known in the Congo Basin and recorded by Torday as Ba-jok. They were a congeries of cannibal tribes speaking a very interesting type of Bantu language (as I have only recently discovered, owing to information supplied by the officials of the British South Africa Company), a type of language which with its congeners suggests unmistakable affinities with the Nyanza group (Lu-nyoro, Lu-ganda, etc.). The Jagas or Va-kioko poured forth in irresistible hordes from the mountains and plateaus of Eastern Angola northwards to the Lower Congo, and southwards to the Zambezi basin. They spread over this latter region like a lava flood, till they reached almost to the Zambezi delta, destroying everywhere the nascent Portuguese power. Checked and thwarted to some extent by the despairing Portuguese, branches of them turned up northwards through Nyasaland (where their descendants still remain) and into the Mozambique country. They dealt a blow at the splendid old town of Kilwa, from which it has never recovered, and their course of devastation and effacement of Arab and Portuguese civilization was only stayed within sight of Mombasa Island, where the Portuguese finally smashed them up with the aid of the Swahili Wa-segeju.

Much about the same time, however, the northern overflow of the Va-kioko destroyed the Portuguese Christianized Kingdom of Kongo and the Portuguese power there, and even extended across the Lower Congo into the Loango country. For quite a century afterwards they dominated all the interior of Angola. It was the uprising of the Va-kioko which prevented the creation of a gigantic Portuguese Empire over Central Africa, much more than any strength of the Arabs, and it occurred unhappily—I write "unhappily" because in the main the work of the Portuguese has

been very beneficial to Africa—at a time when the Portuguese monarchy itself was struck down by the extinction of the Avis dynasty.

Owing to this cause Portuguese exploration of the Congo was arrested, and though it was resumed in a feeble fashion in connection with the Italian, Flemish, and French missionaries of the later seventeenth and eighteenth centuries, it may be asserted dogmatically—so far as our existing knowledge goes—that the Portuguese had no knowledge of the existence of Stanley Pool. They had heard of the Bateke tribe, and their commerce through the Bateke reached to the shores of Stanley Pool; but of the existence of this lake-like expansion of the Congo they give no indication. They knew, of course, the Upper Kwango River, and at the close of the eighteenth century and commencement of the nineteenth they revealed, mainly through native information, the existence of the Lualaba and the Luapula. Yet here their actual explorations were more remarkable for what they missed than for what they discovered. On several occasions they reached within a few miles of the Great Lakes, yet failed to hear of them, to see them, or to record them on their maps. A Portuguese traveller certainly sighted Lake Nyasa about fifteen years before Livingstone and Kirk, possibly even crossed its south-western gulf, and before Livingstone actually discovered the lake from the point of view of scientific geography the Portuguese had indicated the existence of its southernmost extremity. Yet it is doubtful whether they would have done this had the existence of the lake not been announced by the Württemberg missionaries of East Africa on the strength of Arab information.

I have shown in numerous writings so great a desire to do justice to the Portuguese that I cannot be accused of wishing to belittle their achievements; but I confess to some irritability at the constant recurrence of the easy-going myth that they knew all about the geography of Central Africa in the sixteenth and seventeenth centuries and therefore had anticipated the discoveries of Livingstone and Stanley.

I am quite willing to admit that it is very probable that in the closing years of the fifteenth century they had even sighted the Niger in Senegambia and thereby had anticipated Mungo Park. They may even have reached Timbuktu—it would have been very easy in those days before, in that region, Muhammadan fanaticism was awakened by the subsequent Moorish and, above all, Spanish-Moorish conquest of those regions. They certainly made a journey to the semi-civilized kingdom of Mosi far to the north of the Gold Coast and thus anticipated Binger; but unless Sir Francis Fox's map is one of those amazing discoveries the importance of which can pass unperceived for century after century (and it is difficult to believe this with such representatives of scientific history at the Cape as McCall Theal and Dr. L. Péringuey) nothing will convince me that the Portuguese knew anything about the Congo eastward of Léopoldville, or that their knowledge of Nile geography extended beyond the confines of the Ethiopian Empire.

REVIEWS.

EUROPE.

The River Severn.— M. Lanchester. London: Murby & Co. 1915. Pp. 72. *Illustrated by Pen-and-ink Sketches.* 2*s.* 6*d.*

THE author's aim is to illustrate the Severn from source to mouth. The chief geographical stages in its course are simply and clearly described in a manner which should make the book an admirable reader for children. The sketches of the river, though slight, are sufficient to bring home the important differences in its valley. Of great interest are the numerous sketches of old survivals, such as the "coracle," like an enormous walnut-shell made of bent wood and covered with stout canvas well tarred, which was commonly used till lately by fishermen; and the bridge on the Newtown Canal, in which the weight is so accurately adjusted that by pulling the chain with one hand the whole of it can be raised to allow a barge to pass. There is a charming picture of the Wrekin and of High Rock above Bridgenorth. The author is perhaps happiest in her sketches of towns which usually illustrate some important geographical feature. For example, that of the Stoneway Steps at Bridgenorth helps to emphasize the steepness of the hillside on which the town is built, the entrance to many of the houses being on the top floor.

AFRICA.

A History of the Gold Coast and Ashanti. From the earliest times to the commencement of the Twentieth Century.— W. Walter Claridge, Senior Medical Officer, W.A.M.F., Gold Coast. Introduction by Sir Hugh Clifford, Governor of the Gold Coast. 2 vols. *Maps.* London: John Murray. 1915. 36*s.* net.

Sir Hugh Clifford, in his introduction to Dr. Claridge's 'History,' says that it "illustrates with peculiar force the curiously haphazard fashion" in which many of the British colonies in the tropics have come into being. This is true, and the illustration is the more instructive as Dr. Claridge does not, save for a few brief general statements, bring down his record beyond the beginning of 1902. That is, the 'History' stops at the point when Great Britain had been forced to assume definite responsibility for a large area of West Africa and had reaped none of the rewards. Fortunately Sir Hugh Clifford to some extent makes good the deficiency. He draws a well-justified picture of the present prosperity of the Fanti and Ashanti alike, "peasant proprietors who, among other things, produce annually more than a fifth of the total cocoa crop of the world." This peaceful and prosperous condition deserves emphasis, as the author gives the impression that he is not satisfied that the Ashanti have yet accepted loyally British sovereignty. Sir Hugh Clifford's introduction is a corrective to Dr. Claridge's apparent pessimism.

The author deals briefly with the origin of the Gold Coast tribes, the record becoming much fuller when we reach the era of European discoveries. We are given a precise account of the Portuguese period, of the rivalry of France and England, the coming of the Dutch, and of the Swedes, Danes and Brandenburgers. Students of historical geography will be grateful for the tabulated history of every fort on the coast.

Dr. Claridge devotes a chapter to the evidence concerning the extent of the knowledge of the West Coast possessed by the Ancients. His suggested identifications of the places mentioned in the Periplus command respect, if not

acceptance; he thinks that the account of the voyage indicates that Hanno sailed as far as the Cameroons. Dr. Claridge writes with good judgment on another vexed point—the claim of the Normans to have discovered the Gold-Coast prior to the Portuguese. The evidence in favour of the French claim "is somewhat inconclusive and meagre," but it is sufficient to forbid our dismissing the claim as disproved.

Never before has the story of the dealings of the British and other Europeans with the Gold Coast and Ashanti been told so fully; indeed, so packed is this book with facts that the narrative on occasion tends to become a chronicle of events rather than a true history. We should have been glad if some of the records had been condensed and more adequate accounts given of the early migration, mentality, social life, religious beliefs, industries and handicrafts of the Fantis and Ashantis. A more thorough treatment of the effects of missionary enterprise and of the gold and slave trades might also reasonably be expected. A chapter might likewise have been devoted to a description of physical features. Geographical factors have had a profound influence on the history of the West Coast. These factors Dr. Claridge scarcely sufficiently emphasizes, and we agree with Sir H. Clifford in the belief that he considers the climate worse than it is. Several of the causes of the former great mortality among Europeans are preventable, and not inherent in the climate.

There are six or seven sketch-maps in these volumes, including one (after d'Anville) giving the distribution of the native states in 1729. We should have liked more maps. A map of the Ashanti empire, defining its limits at various periods as well as the boundaries of its component states, is sadly to seek. A political map showing the parts of the coast held at different periods by European nations and the gradual spread of British influence inland would have been welcome.

No historian can be, perhaps no historian should be, absolutely impartial, and Dr. Claridge writes as, one may say, a pro-Ashanti, without however neglecting to present the case for the other side. This bias gives a certain piquancy to the story of the British dealings with the Ashanti. While the book is lengthy—there are over 1200 pages—the attention of the reader is sustained both by its intrinsic interest and by the fluent style of the author.

F. R. C.

Egypt of the Egyptians.— W. Lawrence Balls. London: Pitman. 1915. Pp. ix., 249. *Maps and Illustrations.* 6*s.* net.

The author has spent nine years in Egypt and is well qualified to speak authoritatively on native problems. He deals in the first three chapters with the history of Egypt. Here space has obliged him to compress almost to the limit of real utility. The rest of the book is more satisfactory, especially the account of irrigation and crops and the influence of geographical conditions on the life and ideals of the fellahin. The author's aims are admirably illustrated in the introduction, where he says, "The whole problem of Egypt is one of education, though not in the ordinary sense. Let it be clearly understood from the commencement that the average modern Egyptian can do certain things, within a limited range of activities, better than any one else; he will, for example, take a field of uneven land and arrange it in a series of plots differing in level by steps of an inch or two from one another, and without more than an inch of variation in level within any one plot, so that all can be irrigated easily from the highest corner of the field thus made; and this he will do with only his eye to guide his actions." In other words, the author sets himself to explain

the mental attitude of the fellahin by describing thoroughly his environment, and has produced a readable work which is popular without the loss of scientific accuracy. Many of his descriptions of scenery are remarkably graphic, and the illustrations, which are well chosen, have as a rule a rather unusual geographical value. On the whole the book is to be recommended to all interested in the modern development of Egypt.

AUSTRALASIA AND PACIFIC ISLANDS.

An Untamed Territory.— Elsie R. Masson. London: Macmillan. 1915. Pp. xii., 181. *Maps and Illustrations.* 6*s.*

This book, short as it is and dealing mostly with the personal experiences of a visitor to the Northern Territory of Australia, is a really valuable addition to the literature on that territory. It is so because the writer has an excellent gift of description and a power of avoiding trivialities. Her accounts of a motor journey into the bush—a pioneer journey by car—of the deserted station of Port Essington, of the trip up the Roper River, and of the trial of natives for the murder of a white man, are admirable of their kind, and these are only a few examples of a series of vivid verbal pictures.

The book will supply in the future an interesting record of the condition of the territory in its present stage of transition towards that full development and prosperity to which those who have set their hands to it still look forward with confidence, although this "untamed" land has repulsed till now so many efforts towards its reclamation. The name of the writer gives reason to expect a high literary standard and that expectation is not disappointed; the book is both well written and well constructed, and if it be the first the writer has put forth, it may be hoped that opportunities for further work of this character will not be denied to her.

GENERAL.

Sport, Travel, and Adventure.— A. G. Lewis. London: T. Fisher Unwin, Ltd. 1915. Pp. 352. *Illustrations.* 10*s.* 6*d.* net.

A collection of extracts from a large number of books of travel, most if not all of which have been published by Mr. Fisher Unwin. The editor naïvely remarks that it is hoped the perusal of these samples will send readers to the originals. The extracts have been made with judgment, to suit the popular taste, and are skilfully grouped according to subjects. They are varied in character, and have a wide geographical range.

Portolan Atlas: Joan Martines en Messina Añy 1582.— Facsimile, with Introduction by **Edward Luther Stevenson, Ph.D.** New York: Hispanic Society of America. (London: Quaritch.) 1915. Size 25½ × 19½ ins. 55*s.*

The Society is once more indebted to the Hispanic Society of America, through its energetic secretary Prof. E. L. Stevenson, for the gift of a splendidly produced facsimile of one of the examples of early cartography possessed by that Society. The Portolan Atlas of Joan (Joannes) Martines, made at Messina in 1582, is a fine specimen of the later MS. atlases which continued to be produced in Italy and elsewhere long after the developments of printing and engraving had provided the public of those days with more easily multiplied aids to geographical knowledge. This is the later of two separate atlases by the same author in the possession of the Hispanic Society, and one of nineteen different charts or atlases known to have been produced by him at Messina—several of them now preserved in the British Museum—at dates

between 1550 (or 1556) and 1586. Prof. Stevenson supplies a useful list of these works of Martines, with references to the literature in which further details about them are to be found. The present example contains five sheets, which are reproduced in the exact colours and size of the original, and form an attractive specimen of the work of the time. They cover the whole coast-lines of western Europe and of the Mediterranean, as well as the whole west coast of Africa terminating at the Cape of Good Hope. The general style recalls that of similar productions of the period, especially others of the Italian school such as those of the family of Olives (cf. *Journal*, vol. 45, p. 342). There are distinct resemblances between the present maps and the chart of 1568 by Domingo Olives, reproduced by Nordenskiöld in his 'Periplus' (Plate XXIX.), showing that the two examples at least belong to the same family of maps, even if the connection between them is not more direct still. The sheets are covered with the usual system of loxodrome lines, in the conventional arrangement of colours, and have the elaborately coloured compass-roses which are a feature of such maps. While some of the latter are of the type called the Messina type by Prof. Silvanus Thompson (in his paper on the compass-rose; cf. *Journal*, vol. 45, p. 442), and figured by him from another chart of this same Martines, others (particularly the most elaborate) seem to form a link with other types in the use of the fleur-de-lys for the north point. As in other maps of the time, the charts are copiously decorated with flags of various nations, representing the political ownership of the respective lands, and these, with their various quarterings, would no doubt be worthy of study by those interested in Heraldry—if indeed their accuracy is to be trusted. The charts which cover parts of the Atlantic represent several of the fictitious islands which occur on so many early maps, including the large "Frixlanda," north-west of Ireland.

E. H.

Some Frontiers of To-morrow: An Aspiration for Europe.— L. W. Lyde, M.A., F.R.G.S. London: A. & C. Black. 1915. Pp. vi., 120. *Sketch-maps.* 2*s.* 6*d.* net.

Prof. Lyde has expanded the lecture which he delivered before the Society in December 1914 into this little book, whose aim is stated to be to provoke and, if possible, to assist further discussion about desirable political frontiers in Europe. With this object in view he not only lays down the general principles which should in his opinion determine frontier lines, but also in certain special cases plots in some detail the lines which seem to him to conform best to the principles laid down. Those who are acquainted with Prof. Lyde's work will hardly need to be told that the treatment throughout is "provocative," in the sense of being well adapted to arouse eager discussion both for and against the various proposals. But this is only another way of saying that the book will certainly fulfil the purpose for which it has been written. Even those who have in their own minds the clearest conception of the frontiers which seem to them desirable will learn much from the vivid presentment of particular problems given here; while those who have no special convictions in the matter will probably find that the book forces them to acquire such, if only because Prof. Lyde contrives to tilt against some of their most cherished prejudices. If in what follows the reviewer seems to disagree rather than to agree, this only means that, in our present warlike mood contested territory is more interesting than neutral ground.

Prof. Lyde begins by laying down three conditions which should be satisfied

by frontiers, these being that they should be national or where not national, "assimilative," and that they should be as far as possible anti-defensive. The last note recurs again and again in the course of the book, for Prof. Lyde insists that frontiers should be drawn with a view to peace and not to war, and that therefore the best frontier is that where nations may meet in the ordinary routine of peaceful intercourse, as across a navigable river.

For those of us who have somewhat lost faith in the proximate disappearance of war even from Europe this is a hard saying. The most obvious example of a river frontier in the present war has been the Serbo-Austrian frontier, and the condition of Belgrade at the moment is a pathetic witness to its dangers. The best examples of defensive frontiers are the Italo-Austrian frontier and the Vosges region. Can we expect that a world which has seen the plains of Flanders and North France drenched in the blood of civilians, and red ruin spread over fertile lands there, will fail to note that in Alsace and the Trentino the sufferings of the non-combatant population have been in comparison small? Can we doubt that this lesson has been burned in upon the consciousness of those who will determine the new frontiers?

The criticism is serious, for, as already stated, Prof. Lyde works out his own principles in detail, and many of his frontiers, till the Prussian changes his skin, can only be described as a perpetual invitation to the invader. The suggested northern boundary of Poland, for example, takes for part of its course an approximately east-and-west line across the Vistula in the vicinity of Bromberg, the present province of Posen making a Polish enclave in German territory. One feels that such a frontier would last for precisely the length of time necessary for the Prussians to recover breath, unless, indeed, the Poles were sufficiently prudent to forestall that moment by breaking through to the sea themselves.

Among other points of interest we note that Prof. Lyde takes a very conservative view of the probable fate of the Austro-Hungarian monarchy. He makes no mention of a possibly independent Bohemia, while southern Slav aspirations are not very sympathetically treated. On the other hand, as he has already explained here, he looks with a very favourable eye upon the Albanians, whose claims to form an independent state he regards as irrefutable. Space does not permit of the full discussion of this interesting question here, but we cannot help expressing a doubt whether the statement that the Albanians "are the old Thraco-Illyrian strain, of the same tall and fair type as conquered the Persians and built the Parthenon" has sufficient evidence in its favour. Pittard, working with admittedly incomplete material, doubts the existence of any pure racial strain in the Balkan Peninsula. Further, as to colouring, he finds that the Albanians have generally brown eyes and dark or very dark hair. The individuals examined in detail have been relatively few, under two hundred in all, but they came from various parts of the country and showed only 9 per cent. with blue eyes, and 4 per cent. with fair hair. Pittard himself regards the origin of the Albanians as an insoluble problem. The question is, however, one of purely academic interest, for the future frontier lines are scarcely likely to be determined on the basis of anthropological observations.

We have only touched upon a few of the interesting questions raised; almost all those discussed are matters upon which the ordinary educated individual ought to have an opinion, and the book will assist in the formation of reasoned judgments among the members of the general public. It deserves to be widely read.

M. I. N.

Prehistoric Man and his Story. A Sketch of the History of Mankind from the Earliest Times.— Prof. G. F. Scott Elliot. London: Seeley, Service & Co. 1915. 7*s.* 6*d.* net.

Prof. Scott Elliot has had the courage to attempt a sketch of the history of man from his simian forebears to the Iron Age, and that not merely in Europe but throughout the whole world. In his preface he says, "It would surely be a great pity if ordinary intelligent readers could no longer follow comfortably the most interesting of all sciences;" he has therefore avoided technical terms wherever it was possible, and as far as convenient the repetition of what has already been given in full detail in books of the same nature, and has preferred alluding to foreign authorities as being less accessible to the general reader. He adds, "It must also be remembered that to every question . . . there are not merely two, but several sides. The solution is always a matter of probability and balance of evidence." He has "selected that solution which seems the most satisfying" to himself, but some of his readers may be disposed to take other views. The inexpert reader may however feel confident that on the whole he is being guided wisely, and the useful bibliography at the end of each chapter will enable the student to check the evidence and proceed further in the study. At times there seems to be a tendency to refer to somewhat sensational views, possibly with the intention of interesting the reader, although the author himself may not agree with them. For example, without wishing to detract in the least from Dr. Ameghino's labours in palæontology, it must be remembered that he was not an anatomist, and his conclusions regarding fossil human remains in South America have been satisfactorily demolished by Hrdlicka (pp. 41, 256). The author tacitly admits this, and it seems unnecessary to leave an impression in the mind of the reader that there may be something in the views quoted. The same objection applies to his reference to Prof. Sergi's hypothesis that man arose in South America. Prof. Scott Elliot knows perfectly well that the ancestors of man belonged structurally to the old-world monkey type, of which no example, recent or extinct, has ever been found in America, and till some evidence is forthcoming it is futile to raise baseless theories which can only distract the general reader (p. 85). Does the author really believe that the effigy-flints (pl., p. 30) were really partly shaped by man? They are not alluded to in the text. It is scarcely correct to say that the colour of the skin is regarded as being the character most distinctive of race (p. 96); every student knows how frequently it fails. When he says that the aquiline nose is characteristic of many Australians, is it not probable that he means Papuans? On the other hand, the native drawing (Fig. 12, p. 170) represents Australians and not "people living in New Guinea." The dancing of the Bushman at Cambridge (p. 184) was certainly a very remarkable performance, and showed great terpsichorean skill, but it was a medley of music-hall turns, and there was very little native dancing in the performance. In an interesting chapter on the first herdsmen an account is given of dogs and domesticated ungulates, and most of the credit of the domestication of animals is ascribed to the brachycephalic type of mankind (p. 211). The chapter on "The American Puzzle" is also good, but Prof. Scott Elliot is, as he admits, offering an hypothesis which has no very definite proof when he suggests that the founders of the plateau civilizations of Central and South America "were almost the sole survivors of the original dolmen builders of Japan. In that country they had settled on the best lands, dispossessing the original Ainu and cultivating the ground by their usual methods of irrigation—that is, by intensive and *petite* culture. They were in the Copper period, with an

advanced astrology, and worshipped the sun, moon, and stars" (p. 268). Prof. Elliot Smith, in his 'Migrations of Early Culture' (Map 2), indicates that the megalithic, or, as he prefers to call it, the "heliolithic" culture-complex in its migration from Africa diverged in the West Pacific northwards to Japan and southwards and eastwards to Peru. The book is written in a clear and attractive style, and the multiplicity of data are controlled by generalizations and hypotheses which stimulate the imagination of the reader.

A. C. H.

Sandford Fleming, Empire Builder.— Lawrence J. Burpee. London: Milford. 1915. Pp. xxiii., 285. *Illustrations. Price* 10*s.* 6*d. net.*

Sir Sandford Fleming, whose life-story is well told in this book, died on 22 July 1915, at the age of 88. He first crossed the Atlantic in 1845 in an old-fashioned sailing ship when the dawn of the era of ocean steamships had barely opened. The author has reproduced a very interesting facsimile of a passenger's contract ticket which shows the primitive character of the accommodation provided at that date.

Montreal then only contained about sixty thousand inhabitants, one-tenth of the present population, and the present gigantic railway systems were represented by one little strip of track from La Prairie to St. John's, connecting Montreal with the Champlain Valley, and even this was shut down in the winter. Such canals as there were at that date were only adapted to small shallow-draught vessels. The value of town sites in those days is well illustrated by the acceptance of a farmer, in payment for a load of hay, of a vacant lot in Toronto which was sold not long ago for a million and a quarter dollars.

Sandford Fleming began his important railway work on the Great Northern where he was first assistant engineer and finally chief. He was one of the first to see the importance of transportation facilities in developing the hinterland beyond the Great Lakes, and in 1863 went to England to present a memorial on behalf of the Red River Colony praying for the establishment of intercommunication between the Eastern Provinces and British Columbia, by way of Lake Superior, the Red River country and the Saskatchewan, but neither the Imperial nor the Canadian Government as yet realized its importance.

On his return to Canada he was entrusted with the survey of the Inter-Colonial Railway. In his report, made in 1865, he outlined his scheme for a short ocean passage from Newfoundland to Ireland, and arranged at his own personal expense for the survey of the route across the island which was subsequently followed by the railway. In 1871 he became chief engineer to the Canadian Pacific Railway, and until 1880, when he accepted the appointment of the Chancellorship of Queen's College, Kingston, was engaged on surveys and to some extent in building the actual line. The author describes fully the difficulties incurred and the different routes suggested for crossing the Rockies. The route selected was the Yellowhead Pass, but in 1883 the Kicking Horse was chosen in its place. Sandford Fleming was asked to return to Canada from London to settle the problem. The Selkirk Range was not known to have been crossed anywhere near the proposed line, and a remarkable journey was made along the suggested route from Kicking Horse Pass. A way was finally found across the Selkirks by Major Rogers following the Bear and Illecellewaet Rivers. Sandford Fleming was the principal mover in the Pacific Cable project, and it was owing to his untiring energy and determination that the line was eventually laid in 1902. If his plans for the securing of Necker Island had been followed it is said that more than 2½ million dollars

would have been saved, as this island, which was then unclaimed, lay on a more direct route than Fanning Island.

Throughout his life he identified himself with all the important schemes of the day which were connected with the improvement of communications, and especially those with Imperial aims, such as the All-Red Telegraph Line, the Imperial Intelligence Service between England and the Colonies, and the time-saving system of Standard Time. It may be noted that he had been for thirty-seven years a Fellow of this Society.

THE MONTHLY RECORD.

EUROPE.

The Earthquake in the Midlands on January 14.

Since the Swansea earthquake of 27 June 1906 no British earthquake has disturbed so great an area as that which occurred in Staffordshire on January 14 at 7.30 p.m. The injury to property was of a trifling character, the intensity of the shock in the epicentral area being not more than 7 of the Rossi-Forel scale. The earthquake was, however, observed at great distances from the origin, and there are few parts of England and Wales, with the exception of the extreme northern and southern counties, in which it was insensible to persons on the upper floors of houses. So far as is at present known, the principal epicentre lay a few miles to the west or south-west of Stone in Staffordshire. That there was a second epicentre at a distance of a few miles from this point is clear from the double character of the shock, the earthquake belonging to the class known as "twin-earthquakes."

A Remarkable Fissure in the Kilpatrick Hills, Stirlingshire.

At the north-western end of Auchineden Hill, just within the Stirlingshire border, there is a remarkable rift, narrow and deep, separating a slice of rock from the cliff which here terminates the main mass of the hill. Its name, variously given as "Whangie," "Wanzie" or "Quhanzie," appears to be derived from a Scottish word meaning "slice," and its alternative designation as a "landslip" also gives an indication of the popular conception of its mode of origin. The question of the true nature of this is discussed in the January number of the *Scottish Geographical Magazine* by Mr. G. W. Tyrrell of Glasgow University, who calls attention to certain features which seem to differentiate the Whangie from an ordinary landslip, though there is no doubt that the severed slice was once united to the main mass. This is shown by the close correspondence of the rock-faces on either side of the rift, which in many places take the form of "backs"—a quarryman's term for curved surfaces frequently originated by blasting. But it is noteworthy that in moving away from the cliff the slice, which is embedded at its base in a large bank of talus, appears to have also moved *upwards* to some extent, and that this cannot be ascribed to tilting, either longitudinal or lateral. The idea that a slip has occurred along a bed of soft material separating the slightly dipping lava-flows of which the hill is composed is not substantiated, the movement having been in a direction opposed to the dip, while there is positive evidence that the rock of the Whangie is a volcanic intrusion or plug which descends to the depths. Mr. Tyrrell makes the suggestion that the separation has been the result of an earthquake-shock,

which, as in the case of an impact to a row of marbles, has been translated into motion at the point where support has been wanting. The upward movement and retention of the *vertical* position may, he thinks, have been due to a slight inclination of the fracture plane at the base, and to the support afforded by the outer talus of *débris*. Some reason is shown for thinking that the feature may be of no very ancient date, but may possibly have been originated by the severe earthquake recorded in 1608.

ASIA.

Desert Tracts in Ceylon.

In the issue of *Spolia Zeylanica* for October 1915 (vol. 10, pp. 166–174) Mr. E. J. Wayland describes some small tracts in the north-west of Ceylon which are remarkable for the desert nature of the surface, though surrounded by jungle which ends abruptly at their edges. They lie on or near the little-traversed road from Puttalam to Mannar, in the North-Western, Northern, and North Central provinces. Their form tends to that of more or less elliptical depressions bounded by scarped faces, and their floor belongs to a series of sedimentary rocks, which in this part of the island vary from compact limestone to arenaceous and calcareous beds, though in the desert areas the compact limestone is represented only by pebbles and isolated fragments. The bounding cliffs are composed mainly, in their upper parts at least, of fertile red earth, supporting a covering of forest. Wind erosion has caused the harder portions of the desert areas to stand out in bold relief and the surface is rough in the extreme. The writer attempts an elucidation of the causes to which these interesting features are due, but though it may explain their persistence when once formed, it hardly seems to account satisfactorily for their original formation or for the limited areas which they occupy. The main points insisted on are: (1) the removal of an original cover of fertile soil from the sedimentaries now exposed; (2) the mechanical nature of the latter, which is calculated neither to easily absorb nor to retain moisture. A decrease of rainfall is also thought likely to have occurred. The roughness of the surface, as noted above, is ascribed to the action of strong winds, yet the writer says that "disintegration through the action of solar heat is the most potent form of weathering in the desert tracts . . .; wind erosion has accomplished comparatively little." He does not clearly explain the agency by which the disintegrated material has been removed, nor why the removal has not extended further. It is, he says, constantly progressing so that the desert tracts are gaining in area. Whatever may be the explanation the paper exemplifies the importance of the maintenance of a soil cover and the difficulties vegetation has to contend against under certain climatic conditions when once it has been lost through deforestation or otherwise.

AFRICA.

A War Relic from South-West Africa.

There has been sent for our inspection by its present owner, Mr. Prescott Row of Waddon, a map of Africa found by Trooper Lithauer of the 1st Imperial Light Horse at Usako's, South-West Africa, when that place was occupied during the march of General Botha's forces through that territory in May 1915. It is interesting as embodying the dream of a German-African Empire entertained by one individual at least in German colonial circles. The whole of the southern limb of the continent as far as the borders of Abyssinia, Lake Chad, and the Cameroon mountain is enclosed within a heavy black line (inserted by hand on a map published by Freiderichsen of Hamburg for the Woermann

line), and marked as "Neu-Gross-Deutschland im Jahre 1916." The only areas excepted from direct German sovereignty are a reserve for the Boers and the small territory of Spanish Guinea, over against which is the legend "Vorkaufsrecht vorbehalten" (right of pre-emption reserved). In Upper Guinea the British and French territories of the Gold Coast and Dahomé are added to Togoland as German, though strangely enough the original owner, who has otherwise given such free play to his fancy, makes no claim to Nigeria. In the centre of the Sahara a plot is marked off and labelled "Reservierte Fussballplatz für zahme Engländer" (reserved football ground for tame Englishmen). In the north Morocco, Algeria, and Tunis are likewise enclosed within a heavy black line as choice morsels to be assimilated. In Europe, Northern France and South-East England, as well as Russian Poland, are similarly marked, though the dreamer has—perhaps in deference to the prejudices of his allies in that quarter—abstained from indulging the fancy of an extension of German sovereignty in the Near East.

AMERICA.

Physical Geography of the Yukon-Alaska Boundary Zone.

We have frequently referred to the surveys along the International boundary between Yukon and Alaska formed by the 141st meridian west of Greenwich. North of the Yukon River the boundary passes through a country almost unknown until the survey was undertaken, and valuable additions to knowledge have resulted therefrom. The survey operations have likewise offered an unusual opportunity for research into the geology and physical geography of the region, and advantage was taken of this by the Geological Surveys of Canada and the United States, which in 1911 and 1912 sent joint expeditions to examine the whole line of country between the Yukon and the Arctic Ocean. The Canadian party, under Mr. D. D. Cairnes, took charge of the southern section between the Yukon and its tributary the Porcupine, and the results of its work are described by Mr. Cairnes in Memoir 67 (1914) of the Canadian Geological Survey. The country was entered by way of Porcupine river, which, though never ascended by power boats until 1909, has proved navigable by small steamboats, at favourable stages of water, as far as the international boundary at New Rampart House. The best time to ascend the river is the high-water period in May and June, immediately after the last ice comes down, but lesser rises may be expected in August and September. The minor tributaries can rarely be ascended except by poling. The climate has an appreciable range from south to north and the precipitation varies greatly from year to year. Warm and delightful summer weather is generally experienced for four months in the year, but the winter is, of course, severe. Forest becomes increasingly sparse as one goes north from the Yukon, and the trees (chiefly spruce, poplar and birch) are of no great size. Wild fruits such as blueberry, bearberry, crowberry, currant, raspberry, and cranberry are abundant. Of the three main physiographic divisions of this part of North America—the Coastal system, the Interior system, and the Rocky Mountain system—the second alone falls to any large extent within the region under consideration, which belongs almost entirely to the Yukon plateau. This is an upland into which the main drainage courses have cut channels from 3000 to 4000 feet in depth, but which where not too much dissected shows a generally even surface with no relation to rock structure, probably dating from the mid-Tertiary period when the whole was more or less reduced to base-level; the subsequent uplift occurring towards the later part of the same epoch. The

original surface is best preserved in the Keele Mountains—the more northerly of the two main ranges which cross the boundary between the Porcupine and Yukon—where deep canyon-like valleys alternate with plain-like uplands. They are composed of Devonian and Cambrian limestones and dolomites, which under the climate of this region prove far more resistant by reason of their compactness than the shales, slates and sandstones of other formations. The other range referred to—that of the Ogilvie Mountains—seems to form an outlier of the Rocky Mountain system, although it too is composed of ancient limestones and dolomites. It is elevated and rugged, and there is no trace here of an old plain-like surface. The paper is illustrated by photographs, showing clearly the chief types of surface, particularly the V-shaped valleys which are a characteristic feature.

The Nevada Earthquake of 2 October 1915.

At 10.54 p.m. (Pacific standard time) on October 2 the state of Nevada was visited by an earthquake of about the same degree of strength as the California earthquake of 1906 (J. Claude Jones, "The Pleasant Valley, Nevada, Earthquake of 2 October 1915;" Seis. Soc. of America, *Bulletin*, vol. 5, 1915, pp. 190–205). The damage caused by it was comparatively slight, houses being sparsely scattered over the epicentral tract. This area lies in Pleasant Valley, a valley which runs roughly north and south between 40 and 60 miles south of Winnemucca. On the east side it is bounded by the Sonoma Range, the western face of which is an eroded fault-scarp. During the movement which caused the earthquake the fault was further accentuated, the freshly formed scarp being traced by Mr. J. Claude Jones for a distance of about 22 miles. The movement was almost entirely vertical, the new scarp varying in height from 5 to 15 feet. The area disturbed by the earthquake is about 800 miles long from north to south, 650 miles wide, and contains about 400,000 square miles. (For a description of other recent fault-scarps in Nevada due to earthquakes see paper by A. C. Lawson in *Bul. Seism. Soc. America*, September 1912, and abstract in this *Journal*, vol. 41, p. 287.)

Saline Basins in California and Possibilities of their Exploitation.

The desert regions of South-eastern California are the site of various basins, at present without outlet, showing indications of former occupation by lakes which in some cases at least are represented by salt deposits, possibly capable of supplying potash in sufficient quantities for successful commercial exploitation. The basin which appears to offer the best prospects from this point of view is that of the so-called Searles Lake—a salt-encrusted valley floor which recent estimates have supposed to contain some 4,000,000 tons of water-soluble potash salts, probably the most promising immediate source of commercial potash in the United States. A preliminary study of this and other associated basins has been made by Mr. Hoyt S. Gale, with a view to ascertaining the geological history of the basins and the nature of existing deposits (U.S. Geological Survey, *Bulletin* 580 L, 1914). The basins described occupy a series of valleys running from N.N.W. to S.S.E., which seem to have formerly been parts of one drainage system. The uppermost basin is that of Owens Valley, traversed by one of the few larger perennial streams of the Great Basin region, which still forms a small salt lake near the southern end of the valley. This must have once overflowed southward into the Searles Basin and this again into the Panamint Valley, which may possibly have been connected with Death Valley to the north-east. The formation of the basins is supposed to have been

the result of tectonic displacements (such as still occur in the region) during late Tertiary and early Quaternary time. The chain of large lakes which once occupied these basins, as evidenced by the elevated shore-lines still traceable, seem to have been formed by the waters of the ice-age, which first filled Owens Valley and afterwards overflowed and flooded the lower basins in succession. With the gradual desiccation of the region the waters become more and more concentrated, but as the overflow from Owens Lake into Searles Basin seems to have been longer maintained than that from the latter into the still lower basins, the main deposits of salts are to be found in Searles Basin. The general result of the study is to confirm the favourable estimates of the possibilities of exploitation of the Searles Basin deposits, but it is thought that the conditions for the formation of thick crystalline masses must have been somewhat exceptional, and that random drilling in the basins in search of salt deposits would not be justified. The question is an important one in view of the large demands for potash made by agriculture and the extent to which it has hitherto depended on the supply from Germany.

Geology and Soils of Antigua.

A lucid sketch of the soils of Antigua as due to the geological structure of the island is given by Dr. H. A. Tempany in the *West Indian Bulletin*, 1915, No. 2. For its size the island shows an unusual variety of geological formations, and therefore a wide range of soil-types, rendering the study one of much interest. Physically the island consists of (1) a central plain running diagonally across from north-west to south-east—generally flat, but with some isolated hills; (2) an undulating tract running parallel with the north-east coast, consisting of limestones rising into ranges of low hills; (3) the volcanic area of the south-west, forming the most mountainous part of the island, with summits of over 1000 feet above the sea. The oldest rocks (Eocene to Miocene) occur in the central plain, and comprise a series of sandstones, claystones, and tuffs with intercalated bands of limestones and schists. They are overlain conformably by the limestones of the north-east (probably Miocene), while the volcanic rocks of the south-east consist of massive igneous flows, with metamorphosed sediments in places. Volcanic intrusives also occur here and there in the other two main divisions. The sketch-map of the distribution of soil-types brings out clearly the influence of the geology, the island being divided from this point of view into a series of belts running also from north-west to south-east, corresponding to the three geological subdivisions and zones of transition between them. Dr. Tempany goes very fully into the physical and chemical composition of soils from each of the subdivisions, showing the importance of chemical differences to the ease of working and suitability for the growth of crops, even when the mechanical character is more or less uniform. Thus while fine silt and clay generally predominate throughout the limestone belt, the presence of a larger proportion of calcium carbonate in the surface soils of the extreme north and east of the belt makes them here generally lighter than in the central portion, where the more pervious soils are liable to great losses of calcium carbonate by leaching. Sugar-cane has been grown with success in such light soils, but recent attempts at the cultivation of cotton, with its deeper root-system, have been less successful owing to the insufficient drainage of the marly subsoil. The lowlying central plain has generally heavy soils, requiring thorough tillage and drainage, but rendered lighter in places by limestone or volcanic outcrops, which cause them to approach the characters of the soils of the other two main divisions. Those of the volcanic district show physically a

more or less even balance between the coarser and finer particles, and are of a distinctly desirable type. Yet they were the first to go out of cultivation with the depression of the sugar industry, and only of late years have serious attempts been made to exploit this area for the cultivation of cotton, limes and coconuts, for the last of which the conditions are especially well adapted.

POLAR REGIONS.

The Drift and Loss of the "Karluk."

The diary kept by Captain Bartlett, who commanded the ill-fated *Karluk* of the Stefánsson Arctic expedition, and after the loss of the vessel made his way over the ice to fetch succour to the survivors, is printed in the *Report of the Department of Naval Service* (Canada) for the year ending 31 March 1915. It enables us to follow for the first time the details of the drift of the vessel in the ice during the latter part of 1913 and the exact circumstances of its final loss on 11 January 1914. The report also includes a connected statement of the doings of the several parties into which the expedition was divided, including the southern division under Dr. R. M. Anderson, which escaped the adventurous experiences of the rest of the expedition, and so has been less heard of, though it appears to have successfully carried out its part of the programme. A sketch-chart is given showing the course taken by the *Karluk* during the whole of her drift from about 145° W. (the most easterly point reached) to the point in which she finally sank, north-north-east of Herald Island. From 21 August 1913 to September 20, when Mr. Stefánsson left the ship on a hunting trip, the course was parallel to and at no great distance from the land, and the same was the case generally until October 5. The movement was then first eastward and then decidedly northward until about 72½° N., the edge of the continental shelf having meanwhile been passed. The further drift was then generally westward (re-crossing the edge of the continental shelf), but with a sudden drop to the south in about 167° W. early in December. The final catastophe occurred in 173° 50′ W., a little north of 72° N. Before the end of the year steps had been taken to be in a state of readiness for a forced abandonment of the ship, and on December 29 indications of land were seen. On January 2 a rumbling noise gave warning of increasing ice-pressure (though there were no other signs of it), the cause being evidently the obstacle to its progress offered by Wrangell Island. Early on January 10 a loud report like the discharge of a rifle was heard, and a tremor was felt throughout the ship. During the day the wind increased to a gale, and at 7.30 p.m. the sheet of ice passing on the starboard side lifted the ship, heeling her to port, and its point penetrated the planking and timbers of the engine room, putting all the pumping gear out of action. The rush of water showed that nothing could be done, and the emergency stores were at once transferred to the ice, which itself helped to keep the ship afloat until 4 p.m. on January 11. The diary records the facts relating to the loss of two parties of four men each during the attempt to reach land, but without adding anything material to previously published accounts. Captain Bartlett's journey over the ice to the Siberian coast, with one Eskimo boy, was quite a *tour de force*, owing to bad weather, rough ice, and frequent leads, which involved many deviations from the direct course. It lasted from March 18 to April 5, and the coast was struck some 60 miles west of North Cape. From the instructions drawn up by Mr. Stefánsson on leaving the *Karluk* it seems that the latter was prepared for the eventuality of being temporarily separated from the ship, and had suggested means of communicating its whereabouts.

OBITUARY.

Captain Wavell.

WE regret the loss of an adventurous traveller in the person of Captain Arthur J. B. Wavell, who was killed in action in British East Africa on 8 January 1916. The eldest son of Colonel R. H. Wavell, he was educated at Winchester and Sandhurst and, joining the Welsh regiment in 1900, served with credit in the Boer war. After the conclusion of peace he did some good work under the War Office, both in Swaziland and neighbouring districts (1904), and in the Bechuanaland Protectorate and Kalahari (1905), being commissioned to execute surveys and report on the districts traversed. In 1906 he resigned his commission and settled in British East Africa with a view to taking up the cultivation of Sisal hemp. From British East Africa it was no far cry to Arabia, the original home of so many of his new associates, and he turned his thoughts thither as a promising field for travel of the adventurous order. On a first journey, in 1908, he undertook the pilgrimage to Mecca and Medina in disguise, and came through the venture in safety, thus adding his name to the comparatively short list of Europeans who have successfully achieved the undertaking. Two years later he returned to Arabia in the hope of carrying out some definite geographical exploration, and chose Hodeida as his starting point for a journey through Yenen into the far interior. But he aroused the suspicion of the authorities, and though he pushed inland to Sanaa he suffered siege and imprisonment there, and was eventually sent back to Hodeida with the object of his ambition unfulfilled. The story of these two journeys in Arabia is well told in his book, 'A Modern Pilgrim in Mecca and a Siege in Sana'a' (1912).

Returning after this to East Africa, he was there on the outbreak of war, and helped in no small way to check the earlier German threats of invasion by raising a force of Arabs, at the head of whom he repelled a determined attack, but was seriously wounded in the left arm. He was in command of a force of Arab rifles when the fatal fight took place at the opening of the present year.

CORRESPONDENCE.

Captain Scott in the Great Ice Barrier.

Meteorological Office, Simla, India, 7 January 1916.

I NOTICE that in Captain Scott's lecture on "The Great Ice Barrier and the Inland Ice," which was published in the *Geographical Journal* for December 1915, I am given the credit for having made the suggestion that "the Barrier is mainly fed by the deposition of snow on its surface, and that the movement results from the expansion of this mass, which would naturally result from its weight."

As I believe that this theory is the correct solution of the Barrier problem, I wish I could accept the credit; but the suggestion was originally made to me by Mr. R. M. Deeley, and I only had the honour of passing it on to Captain Scott.

Before the Expedition left England Mr. Deeley very kindly discussed with Mr. Wright and me many of the ice problems with which we would be faced in the Antarctic, and the suggestions he made and the hints he gave proved of the

greatest use to us in our work. In these circumstances it would be the height of ingratitude for me to let it be thought that I am the author of one of his most valuable suggestions. I therefore trust that you will be able to insert this letter in an early number of the *Journal*, so that Mr. Deeley may have the credit due to him.

G. C. SIMPSON.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1915-1916.

Sixth Evening Meeting, 7 February 1916.—The President in the Chair.

ELECTIONS.—William Curry; Alfred Wm. Pears; Mrs. Elizabeth Charlotte Mackenzie Salwey; Lieut.-Colonel Harry Palairet Verstume-Bunbury, late Royal Scots.

PAPER: Communications in the Balkans. H. Charles Woods.

Seventh Evening Meeting, 21 February 1916.—The President in the Chair.

ELECTIONS.—C. B. Birdwood, Coldstream Guards; Archibald Dunbar Brander; William A. Donaldson; Captain W. R. Hall, C.B., Director, Naval Intelligence Division; Henry Brewer Milner; Gerald Meyrick Part; Lieut. Noel Phillipps, R.E.; Captain Hugo McDowell Pollock, R.F.A.; Alan Faulkner Strickland, R.N.V.R.; Mrs. Helena N. Strickland; Eric Alexander Gordon Stuart; Charles Bruno Thurston; J. A. J. de Villiers; Lieut.-Colonel A. J. Woodroffe, R.E.

PAPER: The Valley of Mexico. Alfred P. Maudslay.

Fourth Afternoon Meeting, 17 February 1916.—The President in the Chair.

PAPER: A Synthetic Method of determining Geographical Regions. Dr. J. F. Unstead.

GEOGRAPHICAL LITERATURE: ADDITIONS TO THE LIBRARY. Edward Heawood, Librarian, R.G.S.

For list of abbreviations see January number.

EUROPE.

Alps—Geological History. **Martonne.**

Atti X. Congr. Int. G., Rome, 1913 (1915): 912–920.

Le rajeunissement quaternaire des Alpes. By E. de Martonne.

Balkans—Ethnology. *Ann. G.* **23–24** (1915): 407–419. **Cvijić.**

Le pays dinarique et les types serbes d'après Mr. Jovan Cvijić. Par Emile Haumant.

Balkans—Historical. **Forbes and others.**

The Balkans. A history of Bulgaria, Serbia, Greece, Rumania, Turkey. By Nevill Forbes, Arnold J. Toynbee, D. Mitrany and D. G. Hogarth. Oxford: Clarendon Press, 1915. Size 8 × 5, pp. 408. *Sketch-maps. Price 5s. net. Presented.*

Monographs by competent writers which will be of great value under present circumstances.

Balkans—Political. **Guéchoff.**

Iv. E. Guéchoff. L'Alliance Balkanique. Paris: Hachette et Cie., 1915. Size 7½ × 5, pp. 252. *Map.*

Of great interest as setting in a clear light much that has been obscure in the recent relations of the Balkan States.

Belgium. *G.Z.* **21** (1915): 601–624. **Kretschmer.**

Belgien. Von K. Kretschmer.

Europe. *Atti X. Congr. Int. G., Rome*, 1913 (1915): 1163–1165. **Supan.**
Die europopäische Halbinsel. By A. Supan.
On the position of Europe in the Geographical Scheme.

Europe—Ethnology. *P.R. Philos. S. Glasgow* **46** (1915): 1–15. **Medley.**
The war and the races in Europe. By Dudley J. Medley.

Europe—Political. *Scottish G. Mag.* **32** (1916): 1–14. **Chisholm.**
Geography and the course of the war. By George G. Chisholm.

Europe—War and Geology. *Contemporary Rev.* **108** (1915): 769–779. **Gregory.**
The geological factors affecting the strategy of the war. By J. W. Gregory.
Concerned mainly with economic minerals—coal, copper, iron, and potash salts—as controlled by the belligerents.

France. *National G. Mag.* **28** (1915): 391–491. **Riggs.**
The beauties of France. By Arthur Stanley Riggs. *Illustrations.*

France—Alps. *Atti X. Congr. Int. G., Rome*, 1913 (1915): 590–596. **Helbronner.**
Description géométrique des Alpes Francaises. By P. Helbronner.

France—Marine zoology. *B.I. Océanog.* (*Monaco*), No. 310 (1915): pp. 4. **Topsent.**
Les dromies sur les côtes françaises de la Manche. Par E. Topsent.

France—Marseilles. ——
Indicateur Marseillais. 75me année. Notice sur Marseille et les Bouches-du-Rhône. Par Jacques Léotard. Marseilles, [1915]. Size 11 × 7, pp. 16. *Illustration.*

Hungary—Lake Balaton. **Lóczy.**
Atti X. Congr. Int. G., Rome, 1913 (1915): 550–560.
La géomorphologie des environs du lac Balaton. By Louis Lóczy de Lócz. *Map.*

Italy. **Fraser.**
Storied Italy. By Mrs. Hugh Fraser. London: T. Werner Laurie, [1915]. Size 9 × 6, pp. 344. *Illustrations. Price* 12*s.* 6*d. net. Presented.*

Italy—Climatology. **Eredia.**
Atti X. Congr. Int. G., Rome, 1913 (1915): 792–813.
Le variazioni del clima in Italia. By F. Eredia. *Illustration.*

Italy—Early Cartography. *Mem. G.*, N. **29** (1915): 239–389. **Codazzi.**
Contributi alla storia della cartografia d'Italia. IV. Carte topografiche di alcune pievi di Lombardia (1608–1611). By A. Codazzi. *Facsimile and Sketch-maps.*
On a series of maps of the parishes of the Milan diocese by Aragonius Aragonius Brixiensis.

Italy—Place-names. **Porro.**
Atti X. Congr. Int. G., Rome, 1913 (1915): 407–414.
Relazione sui lavori della Reale Commissione per la revisione toponamastica della carta d'Italia negli anni 1910–11–12–13. By Carlo Porro. *Map.*

Italy—Sicily—Etna. *Atti X. Congr. Int. G., Rome*, 1913 (1915): 953–963. **Platania.**
Le recenti eruzioni dell' Etna. By G. Platania. *Illustrations.*

Norway. **Beckett.**
The fjords and folk of Norway. By Samuel J. Beckett. London: Methuen & Co., 1915. Size 7 × 4½, pp. xvi. and 308. *Map and Illustrations. Price* 5*s. net.*
A useful book for the visitor to Norway, giving a sketch of its history and a gazetteer of the principal localities.

Poland. *Atti X. Congr. Int. G., Rome*, 1913 (1915): 838–846. **Nalkowsky.**
Sur le charactère transitoire des terres de la Pologne. By W. Nalkowsky.

Poland—Political. *La G., B.S.G.* (*Paris*) **30** (1915): 337–358. **Bienaimé.**
La Pologne. By Georges Bienaimé.

Portugal. **Bell.**
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Geology and coal resources of North Park, Colorado. By A. L. Beekly. *Maps and Illustrations.*

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Some mining districts in north-eastern California and north-western Nevada. By James M. Hill. *Maps and Illustrations.*

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I. A calendar of the leafing, flowering, and seeding of the common trees of the Eastern United States. By George N. Lamb. II. Phenological dates and meteorological data recorded by Thomas Mikesell at Wauseon, Ohio. Compiled and edited by J. Warren Smith. *Illustrations.*

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One of an excellent series of guides brought out by the U.S. Geological Survey with a view to helping the railway traveller "to realize adequately the scenic and material resources of the region he is traversing, to comprehend correctly the basis of its development, and to appreciate keenly the real value of the country he looks out upon."

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Brazil—Exploration. *B. Museu Goeldi (Museu Paraense)* **7** (1913) : 49–92. **Snethlage.**
A travessia entre o Xingú e o Tapajos, pela Dra. Emilia Snethlage. *Map and Illustrations.*
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The Burrinjuck dam and the Murrumbidgee irrigation area. By John M'Farlane. *Sketch-map and Illustrations.*

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Illustrations of the New Zealand flora. Edited by T. F. Cheeseman with the assistance of W. B. Hemsley. The plates drawn by Miss Matilda Smith. Two vols. Wellington, N.Z., 1914. Size 12½ × 10½, pp. (vol. 1), Plates 1 to 121 ; (vol. 2), Plates 122–250. *Presented.*

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The expedition was led by Mr. L. A. Wells, who had previously been in charge of the Calvert Exploring Expedition (*Journal*, vol. **8**, p. 641 ; **10**, p. 444). It carried out explorations on the borders of South Australia and the Northern Territory.

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International Map of the World. By C. F. Close. *Maps.*

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The art of finding your way at night without a compass. By W. A. Tilney. *Illustrations.*

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Die Bedeutung des Vermessungsluftschiffes für die Topographie. By M. Gasser.

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On deep-sea water waves caused by a local disturbance on or beneath the surface. By K. Terazawa.

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The later stages of the evolution of the igneous rocks. By N. L. Bowen. *Diagrams.*

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Rapport du Comité exécutif de l'atlas des formes du relief terrestre. By E. Chaix.

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Treats of the structure and constitution of the Earth.

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Bericht über die Deformation des Erdkörpers unter dem Einfluss des Mondes und die Elastizität der Erde. Von W. Schweydar.

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Note sur les marées de l'écorce terrestre et sur la rigidité du globe. Par Ch. Lallemand.

Glaciology—Ice-structure. *American J. Sc.* **40** (1915): 449–473. **von Engeln.**
Experimental studies and observations on ice-structure. By O. D. von Engeln. *Illustrations.*

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Entwicklungsformen und Verbreitung des Büsserschnees. By J. Früh. *Illustrations.*

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Klimatische Wirkung des grossen asiatischen Monsunsystem in Europa. By E. de Cholnoky. *Illustrations.*

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Das Problem des Busserschnees. Von C. Schoy.

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Smithsonian Miscellaneous Collections **65** (1915): pp. iv. and 159.
A study of the radiation of the atmosphere. Based upon observations of the nocturnal radiation during expeditions to Algeria and to California. By Anders Ångstrom. *Illustrations.*

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Recent oceanographic researches. By Ch. Gravier.

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The geology of the bottom of the seas. By L. de Launay.

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The calculation of total salt content and of specific gravity in marine waters. By Rodney H. True.

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Physiogeographie und vergleichende Landschaftsgeographie. By S. Passarge. *Sketch-maps and Illustration.*

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Le striage du lit fluvial. Par Maurice Lugeon. *Illustrations.*

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I fiumi di tipo friulano ed il loro profilo d'equilibrio. By M. Gortani. *Illustrations.*

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The relation of stream gaging to the science of hydraulics. By C. H. Pierce and R. W. Davenport. *Illustration.*

Zoogeography—Insect devastation. *Ymer* (1915): 273–281. **Trädgardh.**
Människans andel i insektbärjningars uppkomst några biologiskt-geografiska synpunkter. By Ivar Trädgårdh.
On the share of man in devastation caused by insects.

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Archæology. **Droop.**
Archæological excavation. By J. P. Droop. Cambridge: University Press, 1915. Size 8½ × 5½, pp. x. and 80. *Plans and Sections. Price 4s. net. Presented.*

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Civilization and climate. By Ellsworth Huntington. London: H. Milford, 1915. Size 9½ × 6, pp. xii. and 334. *Sketch-maps and Diagrams. Price 10s. 6d. net. Presented.*

Colonization. *P.R. Philos. S. Glasgow* **46** (1915): 125–135. **Falconer.**
The geographical factor in ancient colonization. By J. D. Falconer. *Sketch-map.*

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The migrations of Early Culture. A study of the significance of the geographical distribution of the practice of mummification as evidence of the migrations of peoples and the spread of certain customs and beliefs. By Grafton Elliot Smith. Manchester: University Press, 1915. Size 8½ × 5½, pp. viii. and 144. *Sketch-maps. Presented.*

Historical. **Vibert.**

Théodore Vibert. La Race Chamitique. Préface de Paul Vibert. Paris: E. Leroux, 1916. Size 7½ × 5, pp. xiv. and 416. *Sketch-map. Price* 3*s. net. Presented.*

A highly speculative work, completed before the author's death in 1885, and now for the first time published by his son. M. Vibert appears to have no faith in the generally accepted results of historical research.

Historical—Compass-card. **Thompson.**

The British Academy. The rose of the wind: the origin and development of the compass-card. By Silvanus P. Thompson. (From the *Proceedings of the British Academy*, vol. 6.) London, [N.D.]. Size 10×6, pp. 31. *Illustrations. Price* 4*s. net.*

See note in vol. 45, p. 442.

Historical—Diamond. **Laufer.**

Field Museum Natural History, Anthropological Series 15 (1915): No. 1, pp. 74.

The diamond: a study in Chinese and Hellenistic folk-lore. By Berthald Laufer.

Historical—Land of Darkness. *Z. Ges. E. Berlin* (1915): 448–455. **Hennig.**

Wisû, das "Land der Finsternis." Von R. Hennig.

Discusses the "Land of Darkness" of the Arab geographers (*see* February number, p. 149).

Historical—Schiltberger. *Petermanns M.* 60 (1914): 263–265. **Bergbauer.**

Das Itinerar des Münchener Orientreisenden Hans Schiltberger von der Zeit seines Aufbruchs aus der Heimat (1394) bis zu seiner Gefangennahme durch Tamerlan in der Schlacht bei Angora (1402). Von Joseph Bergbauer. *Map.*

Military history. **Colin.**

The great battles of history. Translated from the French of Colonel J. Colin under the supervision of Spenser Wilkinson. London: Hugh Rees, 1915. Size 8½ × 5½, pp. xviii. and 284. *Maps. Price* 7*s.* 6*d. Presented.*

BIOGRAPHY.

Bird. **Rice.**

Mary Bird in Persia. By Clara C. Rice. With a foreword by the Right Rev. C. H. Stileman. London: Church Missionary Society, 1916. Size 9 × 5½, pp. iv. and 200. *Illustration. Price* 3*s.* 6*d. Presented.*

Miss Bird worked as a missionary in Persia from 1891 to her death in 1914, and her life-story affords a good insight into social and other conditions in Persia, to whose people she was warmly devoted. She came of an elder branch of the same family as the late Mrs. Bishop.

Fleming. **Burpee.**

Sandford Fleming. Empire builder. By Lawrence Burpee. London: Humphrey Milford, 1915. Size 8 × 5½, pp. 288. *Illustrations and Portraits. Price* 10*s.* 6*d. net. Presented.*

See Review, *supra*, p. 219.

GENERAL.

British Empire. **Salmon and Worsfold.**

The British Dominions Year-book, 1916. Edited by Edward Salmon and James Worsfold. London, [1916]. Size 8½ × 5½, pp. 336. *Maps and Illustrations. Presented.*

British Geographical Work. **Howarth.**

Atti X. Congr. Int. G., Rome, 1913 (1915): 205–233.

Review of British geographical work, 1889–1912. By O. J. R. Howarth.

French Geographical Work. **Grandidier.**

Atti X. Congr. Int. G., Rome, 1913 (1915): 152–182.

Rapport sur les voyages et travaux géographiques exécutés par les explorateurs et savants français depuis 25 ans. By G. Grandidier.

Geography. *J.G.* 14 (1915): 97–101. **Henderson.**

The cultural and the training value of geography. By Bertha Henderson.

German Geographical Work. **Hahn.**

Atti X. Congr. Int. G., Rome, 1913 (1915): 183–204.

Die geographischen Leistungen der Deutschen, 1889–1911. By F. Hahn.

Italian Geographical Work. **Bertacchi.**

Atti X. Congr. Int. G., Rome, 1913 (1915): 116–151.

Relazione sull' esplorazione italiana e sulle maggiori opere geografiche, dovute a iniziativa privata, in quest' ultimo quarto di secolo. By C. Bertacchi.

Place-names. *Atti X. Congr. Int. G., Rome*, 1913 (1915): 78–101. **Ricchieri.**

Rapporto della Commissione per la trascrizione dei nomi geografici. By G. Ricchieri.

NEW MAPS AND PHOTOGRAPHS: ADDITIONS TO THE MAP ROOM.

E. A. Reeves, Map Curator, R.G.S.

EUROPE.

Balkan Peninsula. **Gross.**

The *Daily Telegraph* War Map of the Balkan Battle Areas. By Alexander Gross. Scale 1: 550,000 or 1 inch to 8·7 stat. miles. Size 20 by 34 inches. London: "Geographia," Ltd., 1916. *Price 1s. net. Presented by the Publishers.*

This map includes Salonica, with the country to the north and east, and extends from Philippopolis to the entrance of the Dardanelles, and from Uskub to Adrianople. Relief is indicated on the coloured layer system in eight tints of green and brown, the contour intervals being 500 feet up to 1000 feet, from 1000 they are 1000 feet apart up to 5000 feet, after which the interval is 2500 feet. Depth of water is shown by tints of blue in fathoms, the contours given being 10, 20, and 50 fathoms. The map will doubtless be useful at the present time in assisting to follow military operations.

Norway. **Norges Geologiske Undersökelse Opmaaling.**

Geologisk Oversigtskart over det Sydlige Norge. Norges Geologiske Undersökelse 1915. Scale 1: 1,000,000 or 1 inch to 15·8 stat. miles. Size 34 by 22 inches. Kristiania: Norges Geografiske Opmaaling, 1915. *Presented by the Norwegian Geographical Institute.*

A geological map of Southern Norway with the various formations clearly indicated by different colours in the usual manner. Although on too small a scale to give detail, the map will be very useful for general reference.

Norway. **Norges Geografiske Opmaaling.**

Topografisk Kart over Kongeriket Norge. Utgit av Norges Geografiske Opmaaling. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheets: 9 C, Skien; 14 B, Moss; 15 C, Fet; 26 A, Hamar; L 12, Sörfold. Size 15 by 19 inches. Kristiania: Norges Geografiske Opmaaling, 1914–15. *Presented by the Norwegian Geographical Institute.*

Scandinavia. **Hahr.**

Generalkarta ofver Sverige, Norge och Danmark samt angransande delar af Östersjöländer jämte Järnvägs-Kommunikationer. Af August Hahr. Korrigerad till den 1 Juli 1915. Scale 1: 1,000,000 or 1 inch to 15·8 stat. miles. Four sheets each 32 by 24 inches. Stockholm: Beijers Bokförlags Aktiebolag, 1915.

A new edition with railways corrected up to 1 July 1915. The map is clearly drawn and printed in colours. It has already proved most useful to tourists and others travelling in Scandinavia. No hill-shading or other indication of relief is given.

ASIA.

India. **Surveyor-General of India.**

Maps published by the Survey of India during the quarter ending 20 September 1915. **Provincial Maps**: Delhi, scale 1 inch to 4 miles, 1915; Bengal, scale 1 inch to 32 miles, 1915. **District Maps**, scale 1 inch to 4 miles, Cachar (2nd edit.), 1914; Monghyr, 1915. **Degree Sheets**, scale 1 inch to 4 miles, sheets (provisional issue) 78 C, Bengal and Bihar and Orissa, 1915; 55 B, 55 F, Central India and Central Provinces, 1914; 55 G, 55 K, Berar and Central Provinces, 1914–15; 55 O, Central Provinces, 1915; 56 C, Bombay and Hyderabad, 1915; 56 J, Hyderabad, 1915; 56 O, Madras and Hyderabad, 1914; 57 F, Madras and Mysore, 1915; 63 C, Central India and United Provinces, 1914; 64 D, Central Provinces, 1914; 65 N, Madras, 1914; 74 I, Bihar and Orissa, 1914; 78 C, Bengal and Bihar and Orissa,

1915. **Standard Maps**, scale 1 inch to 1 mile, Assam, sheets 78 N–15, 83 B–11, 83 F–4, 83 M–10 and 14 (139), 1914–15; Bengal, sheets 79 B–2 and 6 (287) (2nd edit.), 1913; Bengal and Bihar and Orissa, sheets (preliminary edition) 73 J–11, 73 J–12, 1915; Berar, sheets 55 D–9, 55 D–12, 55 D–13, 55 H–13, 56 A–13, 1915; Berar and Central Provinces, sheets 55 L–1, 55 L–5, 1915; Berar and Hyderabad, sheet 55 D–16. Bihar and Orissa, sheets (preliminary edition) 72 C–8, 72 G–3, 72 H–4, 73 A–4, 73 A–12, 73 E–2, 73 I–2, 73 I–5, 73 J–3, 73 J–6. Burma sheet, 85 M–4 and 8 (160) (2nd edit.), 92 G–14. Central India and United Provinces, sheets 54 N–2, 54 N–3, ; Central Provinces, sheets 55 J–12, 55 K–8; Kashmir and Jammu, sheets 43 F–14, 43 K–14, 43 N–3, 43 N–8. Madras Sheets, 57 L–8, 58 C–6. Madras and Coorg, sheet 48 P–6. Punjab, sheets 43 H–15, 43 H–16, 43 L–4, 44 E–8, 44 I–1, 44 I–5, 44 M–13, 44 O–2, 44 O–5, 44 O–6, 44 O–9, 44 O–10, 44 O–11, 44 O–15, 44 O–16, 53 C–3, 53 C–4, 53 C–7, 53 C–8, 53 C–11. Punjab and Rajputana, sheets 44 O–3, 44 O–7, 44 O–12. Punjab and United Provinces, sheets 53 G–2, 53 G–4. United Provinces, sheets 53 G–8, 53 G–14, 53 G–16, 54 M–15, 54 N–5, 54 N–6, 54 N–7, 54 N–9, 62 D–11, 62 D–12, 63 A–7, 63 A–11, 63 A–13, 63 E–1, 63 E–6, 63 F–4, 63 F–7, 63 F–8, 63 F–12, 63 F–13, 63 I–2, 63 I–5, 63 I–8, 63 I–11, 63 I–16. United Provincesand Nepal, Sheets 62 D–10, 62 H–12, 63 I–14. Calcutta: Map Record and Issue Office, 1915. *Presented by the Surveyor-General of India.*

Syria. **Schumacher.**

Karte von Ostjordanlandes. Aufgenommen von Dr. G. Schumacher. Herausgegeben vom Deutschen Verein zur Erforschung Palästinas. Scale 1: 63,360 or 1 inch to 1 stat. mile. Sheet A 1/2. Size 23 by 22 inches. Leipzig: J. C. Heinrichs, 1913.

Shows the surveys of Dr. G. Schumacher in the country east of the Jordan valley carried out between March and June, 1913, on behalf of the German Palestine Exploration Fund. The area included in the sheet extends from 32° 55′ to 33° 15′ N. lat., and 35° 34′ to 35° 56′ E. long.

AFRICA.

Africa. **Bartholomew.**

Central and South Africa. By J. G. Bartholomew, LL.D., F.R.G.S. Scale 1: 5,000,000 or 1 inch to 78·9 stat. miles. Edinburgh: John Bartholomew & Co., [1916]. *Price, mounted on cloth, 3s. 6d. net. Presented by the Publishers.*

A new edition of this well known and useful map, which includes the whole of Africa south of about 6° N. lat. Boundaries are clearly shown in colour, and it is interesting to notice that the name German South-West Africa has disappeared, and the territory that was formerly so called is now included within the red boundary of British territory. No attempt has been made to indicate relief. There are inset plans on enlarged scales of East London, Port Elizabeth, Cape Town, Lorenço Marques, Durban, and Zanzibar and Pemba Islands with the adjacent coast of German East Africa.

Anglo-Egyptian Sudan. **Survey Office, Khartoum.**

Africa. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Anglo-Egyptian Sudan. Sheets: 54–L, El Gleit; 55–P, Khor Galegu. Size 18 by 27 inches. Compiled and zincographed at the Survey Office, Khartoum, 1915. *Price* 10 *P.T. each sheet. Presented by the Director of Surveys, Khartoum.*

Egypt. **Survey Dept., Egypt.**

Egypt. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Sheets: 3 E, Fayum; 3 F, El Saf; 4 D, Baharia Oasis (Provisional Issue); 4 E, El Minia. Giza: Survey Department, 1914–15. *Presented by the Survey Department, Egypt.*

Four sheets of a map of Egypt on a sufficiently larger scale to be useful for general reference. Sheets 4D and 4E are new, but the other two are reprints of sheets published in 1914, and in the case of sheet 3E with large corrections. The map is printed in colours, and each sheet contains a useful reference to the symbols employed and a note on the data from which it has been compiled.

German East Africa. **E. Stanford.**

Sketch-map of German East Africa and surrounding territories. Scale 1: 2,587,000 or 1 inch to 40·8 stat. miles. Size 28 by 20 inches. London: Edward Stanford, Ltd., 1916. *Price 3s. Presented by the Publishers.*

This map should be useful to newspaper readers and others desirous of following the military operations in German and British East Africa. Boundaries are clearly coloured, with the sea and lakes in blue; otherwise the map is in black.

AMERICA.

United States. **Rand, McNally & Co.**

Rand-McNally Indexed Pocket Maps: North Carolina, scale 1: 887,040 or 1 inch to 14 stat. miles, size 19 by 26 inches; West Virginia, scale 1: 887,040 or 1 inch to 14 stat. miles, size 19 by 26 inches. Chicago and New York: Rand, McNally & Co., 1915.

These are new editions.

AUSTRALIA.

Victoria. **Geological Survey of Victoria.**

Geological Survey of Victoria. Scale 1: 31,680 or 2 inches to 1 stat. mile. Sheets: Bungil; Keelangie; Mudgeegonga; Tatonga. Melbourne: Geological Survey of Victoria, [1915]. *Presented by the Geological Survey of Victoria.*

Upon a black and white outline sketch-map, with hills shown roughly by vertical hachures, the geology is indicated by various colour tints and symbols of which full explanation is given in notes.

PHOTOGRAPHS.

China.

Fourteen photographs of South-West Fu-chien and North-East Kuang-tung, China. *Presented by Mr. S. J. Dunn.* 1916.

These photographs serve well to show characteristic scenery, native villages and dwellings in this part of China. They measure 3½ by 5½ inches.

(1) Hsiao-chi-kang, South-West Fu-chien; (2) South-West Fu-chien, Temple of Hsiao-chi-kang; (3) Fêng-shih, frontier between Fu-chien and Kuang-tung, Han River; (4) The rapids of the Han River, Fêng-shih, frontier between Fu-chien and Kuang-tung; (5) Hakka woman, South-West Fu-chien; (6) Chia-ying Chou paper boat on the Han; (7) Chin-ling on the Han; (8) Liu-huang, Han River; (9) Liu-huang, Han River, Kuang-tung; (10) Kuang-tung, Han River, Kuan-lung; (11) Hakka village, Kuan-lung, on the Han; (12) Kuan-pu, on the Han, Kuang-tung; (13) Chao-chou Fu Bridge; (14) Leng soa, interior of Amoy.

Guatemala. **Stabler.**

Twenty-six photographs of Guatemala, taken by J. H. Stabler. 1912. *Presented by Mr. J. H. Stabler.*

These measure 2½ by 4 inches. The photographs of ancient carvings are specially interesting.

(1) Puerto Barrios, Guatemala; (2) Coming into Puerto Barrios; (3) View of jungle in which ruins of Maya Temple of Quirigua; (4) Alley of monoliths, Maya Temple of Quirigua; (5, 6, and 7) Close view of monoliths at Maya Temple of Quirigua; (8) Section of monolith in Maya Temple of Quirigua; (9) Large stone in form of bull, Maya Temple of Quirigua; (10) Side view of stone bull, Maya Temple of Quirigua; (11) Typical "coche" of Guatemala, near Guatemala city; (12) Church at town of Mixco, near Guatemala city; (13) Market-place, Antigua; (14) Ruined church at Antigua, province of Sacatepequez; (15) Monument of Jesuit missionary, Antigua, province of Sacatepequez; (16) Old colonial arch, seventeenth century, Antigua; (17) Road through Coffee Finca, Antigua; (18) Indians at Antigua, province of Sacatepequez; (19) Indians by Church of Dominicans, Antigua; (20) Volcano of Agua; (21) Guatemala central railroad at Escuintla, with volcano of Agua in distance; (22) Street scenes in town of Escuintla, with volcano of Agua in distance; (23) Street scene in town of Escuintla, with volcano of Agua in distance; (24) One of the largest Ceiba trees in Central America, growing in the market-place at Escuintla; (25) Group of Indians at town of Escuintla; (26) Guatemala central railroad and Indian women near Lake of Amatitlan.

Tunis. **Stabler.**

Forty-five photographs of Tunis, taken by J. H. Stabler, 1912. *Presented by Mr. J. H. Stabler.*

These photographs were taken during a mouflon shooting expedition. Although small, measuring only 2½ by 4 inches, they are clear, and will be useful in the collection.

(1) Jebel, in desert between oases of Tozeur and Gafsa; (2) Spahi, near Tozeur; (3) Horse of Spahi, Tozeur; (4) Mosque of Tozeur; (5 and 6) Date palms, oasis of Tozeur: (7) Camels loaded with dates from Tozeur; (8) Type of ornate brickwork house, oasis of Tozeur; (9) Camel in market-place of Metlaoui; (10 and 11) Mouflon shot in mountains of Djebel, in desert between oases of Tozeur and Metlaoui; (12) Rear view of

temple of Castor and Pollux, Sbeitla; (13) Camels in town of Metlaoui; (14) Oasis of Gafsa from distance; (15) Close view of Forum and Temples of Castor and Pollux, Sbeitla; (16) Nearing oasis of Tozeur; (17) Town of Tozeur, oasis of Tozeur; (18) Camp in wadi in mouflon shooting country in desert between oases of Tozeur and Gafsa; (19) Oasis of Gafsa, taken from the desert; (20) Arab hunters with mouflon near camp in wadi in desert between oases of Tozeur and Gafsa; (21) Temples of Castor and Pollux, Sbeitla; (22) Caravan crossing range of mountains going into desert after mouflon, some miles from the town of Metlaoui; (23) Caravan crossing desert after gazelle; (24) Mouflon shooting in desert of South Tunisia, between the oases of Tozeur and Gafsa, caravan going into desert from town of Metlaoui; (25) Triumphal arch, site of city of Sbeitla, dedicated to Emperor Marcus Aurelius Antonius; (26) Ruins of Temple and Forum of Sbeitla from distance; (27) Marabout in town of Gafsa; (28) Arch of wall of Forum, ruin of Sbeitla; (29) Gulf of Tunis from Carthage; (30) Walls and mosques of Holy City of Kairouan; (31) Caravan in desert between oases of Tozeur and Gafsa after gazelle; (32) Minaret in Grand Mosque of Holy City, Kairouan; (33 and 34) Mosque of Barbier, Holy City of Kairouan; (35) Mosque of the Sword, Kairouan; (36) Gulf of Tunis and the mountains of the Bon Kournine from Carthage; (37 and 38) Roofs of Tunis; (39 and 40) Porte de France, Place de la Bourse, Tunis; (41) Triumphal arch to M. Aurelius Antonius, from a distance, Sbeitla; (42) Marabout in Holy City of Kairouan; (43) Mosque du Bey, in the suks of Tunis; (44) Dome of Grand Mosque of Kairouan; (45) Street in Holy City of Kairouan.

West Indies. **Stabler.**

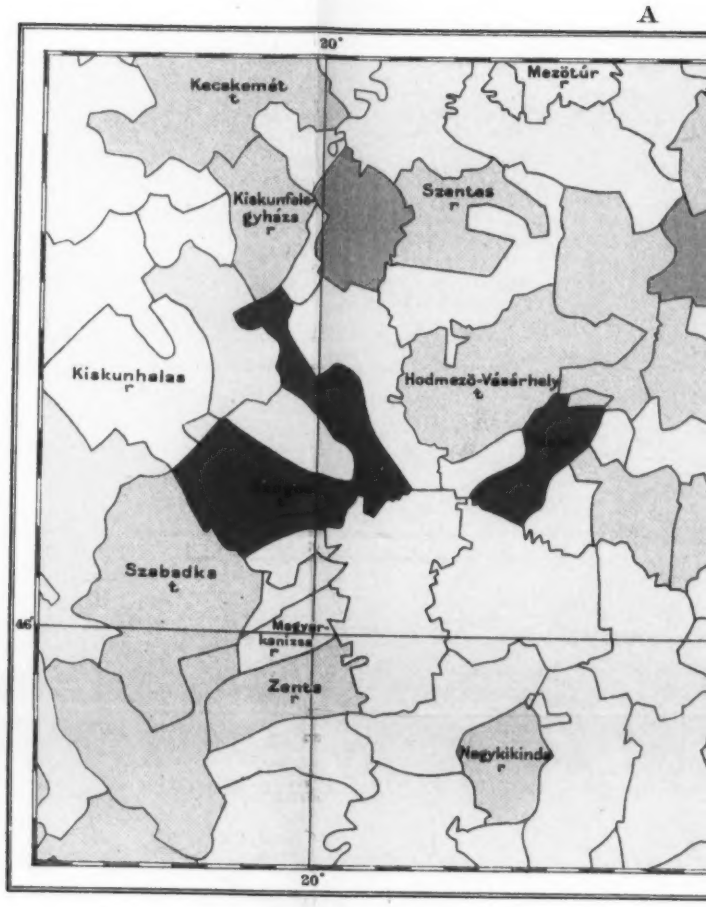
Forty-seven photographs of Haiti and Santo Domingo, taken by J. H. Stabler. 1913. *Presented by Mr. J. H. Stabler.*

The journey during which these photographs were taken extended from Port-au-Prince across Haita into San Domingo. They measure 2¼ by 4 inches, and as but few photographs of this island are in our collection these form a welcome addition.

(1) Island of Haiti from sea; (2) Market-place, Port-au-Prince, Haiti; (3) Main street in Port-au-Prince, Haiti; (4 and 5) Street in Port-au-Prince, Haiti; (6) Lane in Port-au-Prince, Haiti; (7) The Trail, Haitian hinterland; (8 and 9) On the trail, hinterland of Haiti; (10) The Haitian hinterland near the Domingian frontier; (11) The hinterland of Haiti, end of Plaine du Cul du Sac; (12) Manneville at end of Haitian Railway from Port-au-Prince, through Plaine du Cul du Sac; (13) Big interior lake in Haiti, Etang de Saumatre; (14) Etang de Saumatre; (15 and 16) Disembarking from boat on shore of Etang de Saumatre, after boat has lost propeller; (17, 18, and 19) Haitian negroes carrying white man to boat on Etang de Saumatre, near Manneville; (20) Sunset, Etang de Saumatre; (21) Sunset, Haiti, Santo Domingo frontier, Etang de Saumatre from camp at Las Alajas; (22) In a Haitian jungle near Santo Domingo frontier at Las Alajas; (23 and 24) Camp at Las Alajas, Haiti, San Domingo frontier; (25) The kitchen and "Ping Pong" the coon, at camp, Las Alajas; (26) On the trail from Las Alajas to Tierra Neuva; (27) The hinterland of Haiti near Tierra Nueva, 1913; (28) The trail at Tierra Neuva, Haiti-Santo Domingo frontier; (29) Across the Haitian-Santo Domingian frontier, Tierra Nueva; (30) Tierra Nueva looking up to the hills of Grand Bois, where the French had built châteaux in time of French colony; (31) Principal house at Hacienda at Tierra Nueva; (32) Three "gringoes" at Tierra Nueva, Haitian-Santo Domingian frontier; (33) Custom House in Santo Domingo, on Haitian frontier at El Fondo, blown up in 1907 by revolutionaries; (34) In the interior of Santo Domingo; (35) Interior of Santo Domingo; (36) Ozama River, Santo Domingo; (37 and 38) Banks of Ozama River; (39) Native huts on banks of Ozama River, opposite city of Santo Domingo; (40) U.S.S.S. *Nashville* and *Petrel*, Ozama River; (41) Close by the capital of Santo Domingo; (42) Street scene, Santo Domingo; (43 and 44) Plaza in Santo Domingo; (45) Plaza of Santo Domingo with band of Rurales, 1913; (46) Castillo del Hominaje, built by Columbus, the first building in the New world, Santo Domingo, built 1494 or 1495; (47) Ruins of Palace of Diego Columbus, built early in sixteenth century.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

A



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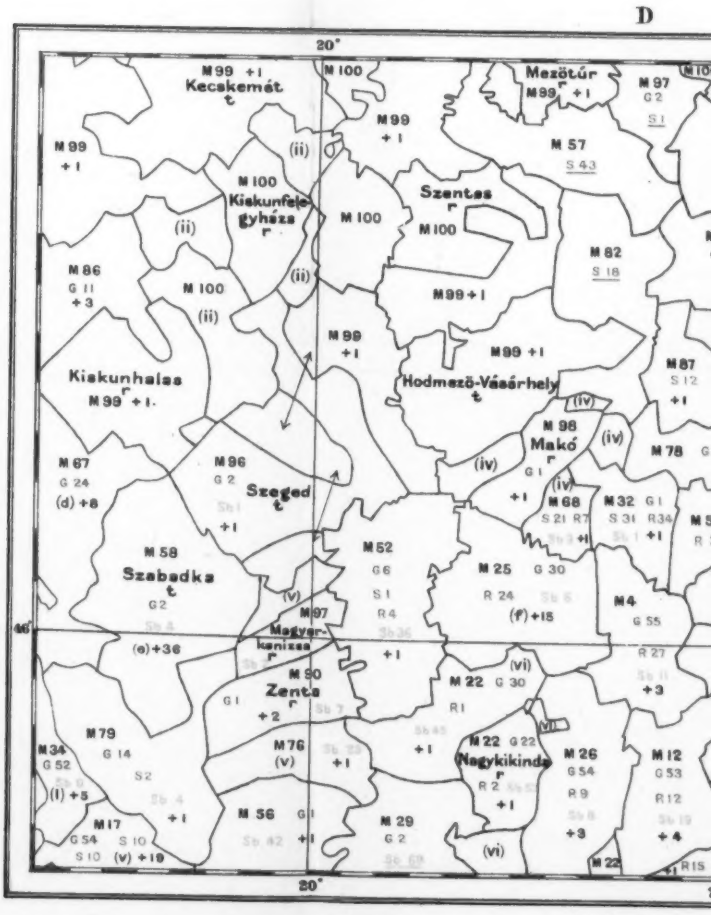

(d) +8 = Schokatzes, Nazarenes
(e) +36 = Bounyevatzes
(f) +15 = Gypsies, Bulgars
(g) +9 = Mostly Bulgars
(h) +10 = Ruthenes 6
(i) +5 = Gypsies, Bounyevatzes
(v) +19 = Ruthenes 17

Reference
M % = MAGYARS
G % = GERMANS
S % = SLOVAKS
R % = RUMANIANS
Sb % = SERBIANS

Maps to ill
B.

DISTRIBUTION OF NA

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r = Town
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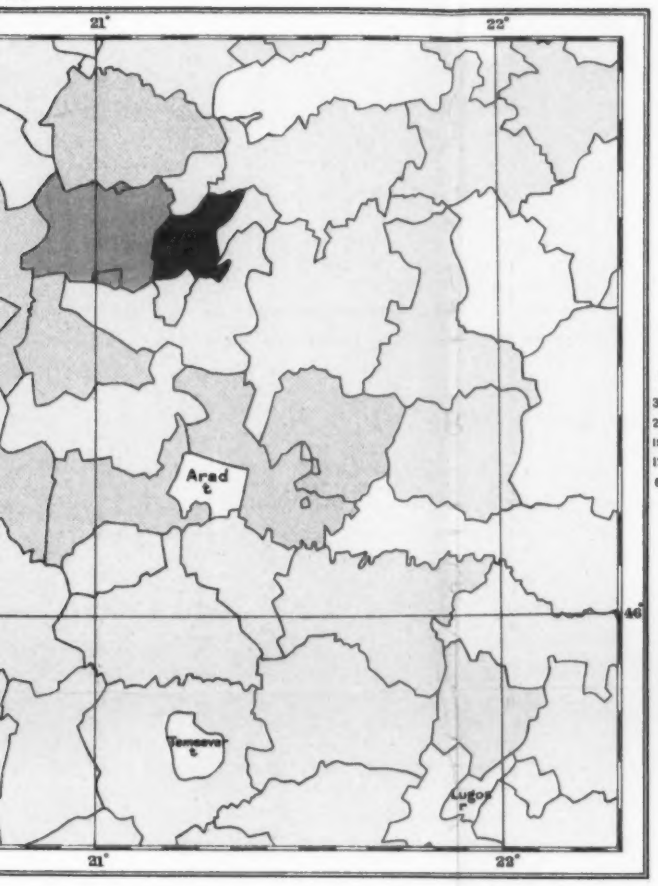
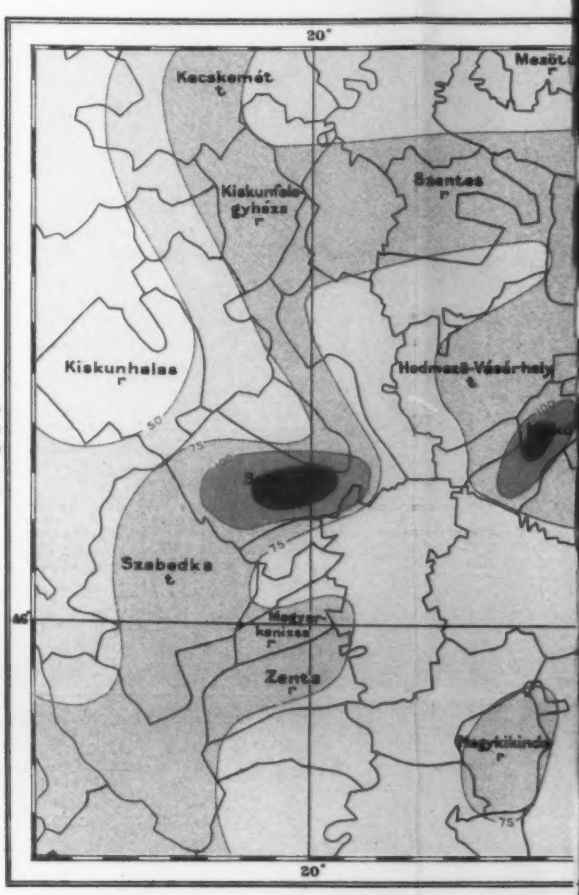


Reference

Per Sq. Mile	Per Sq. Km.
321 - 384	126 - 150
257 - 320	101 - 125
193 - 256	76 - 100
129 - 192	51 - 76
64 - 128	25 - 50



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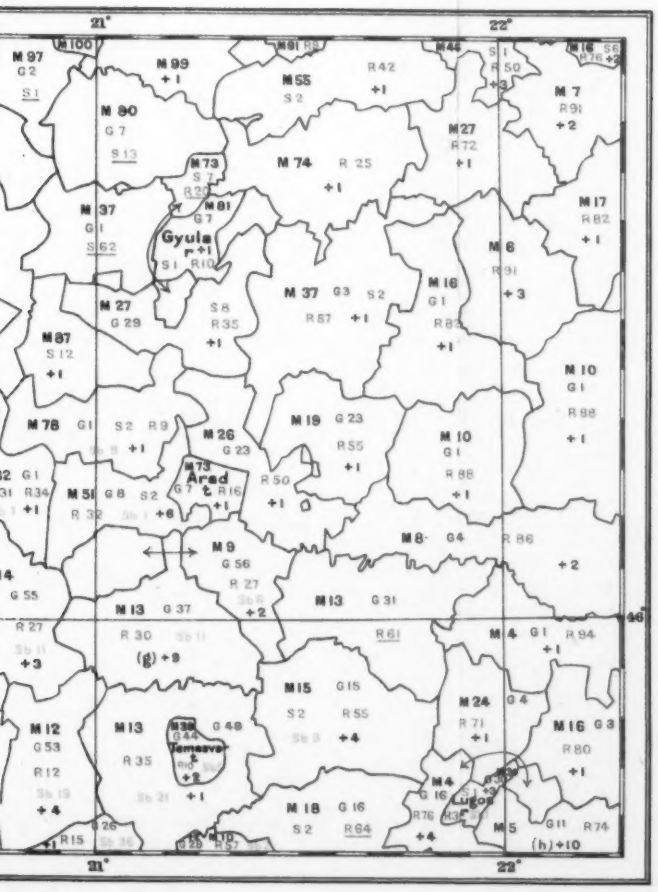

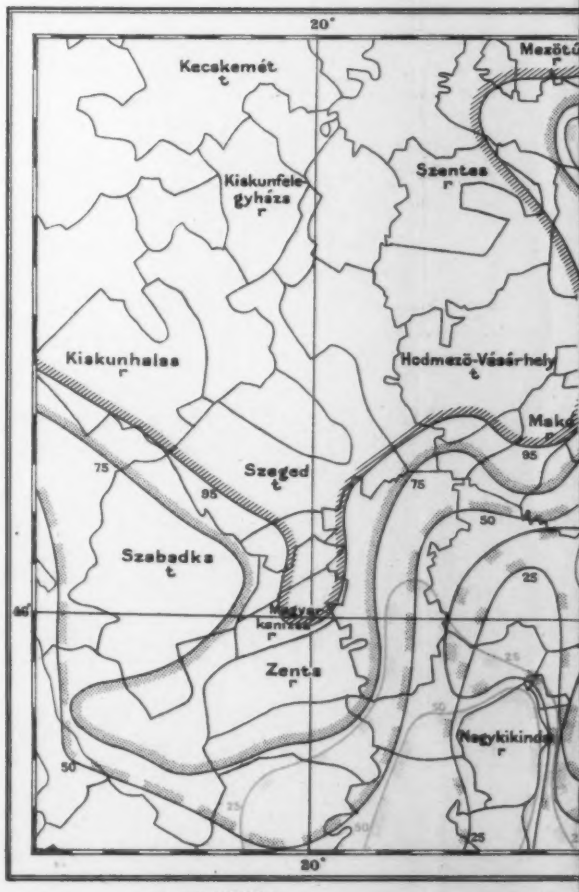

erence
AGYARS
ERMANS
LOVAKS
UMANIANS
ERBIANS

(ii) (iv) } = Detached areas

Over 95%
76 - 85%
51 - 75%
26 - 50%
MAGYARS

51 - 75%
26 - 50%
GERMANS

Published by th

Maps to illustrate the paper by

B. C. WALLIS

on the

OF NATIONALITIES IN HUNGARY

Scale 1:1,250,000 or 1 Inch = 19·73 Stat. Miles

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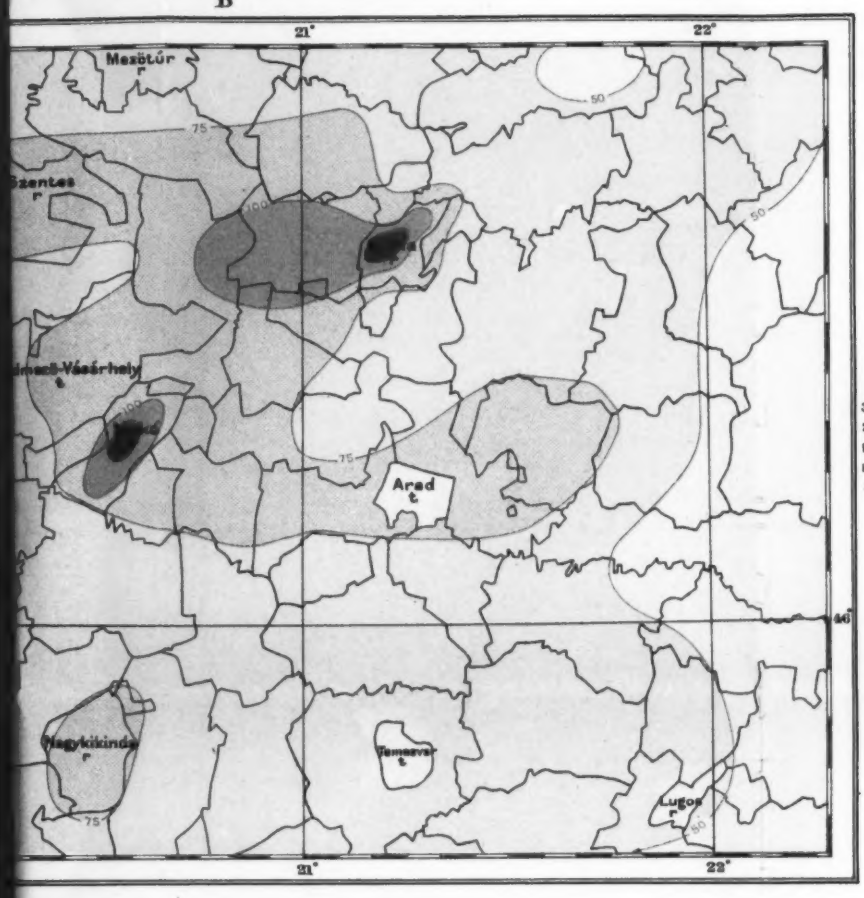
Reference

r = *Towns with organised council*

t = *Municipalities*

REE METHODS OF MAPPING THE DENSITY OF POPULATION

B

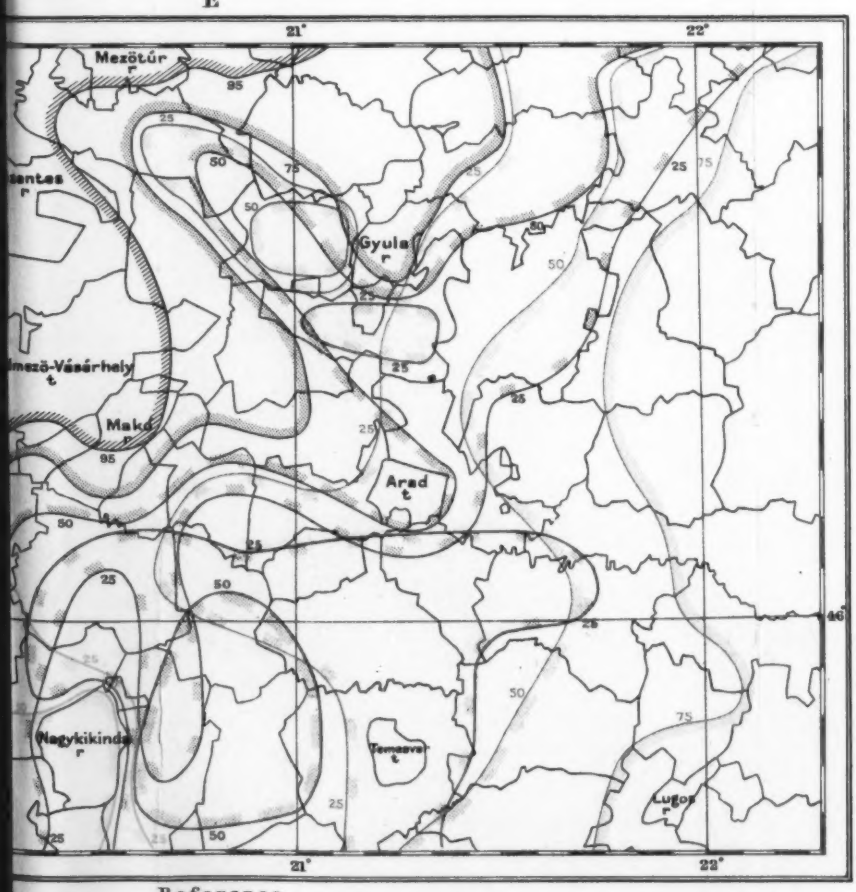


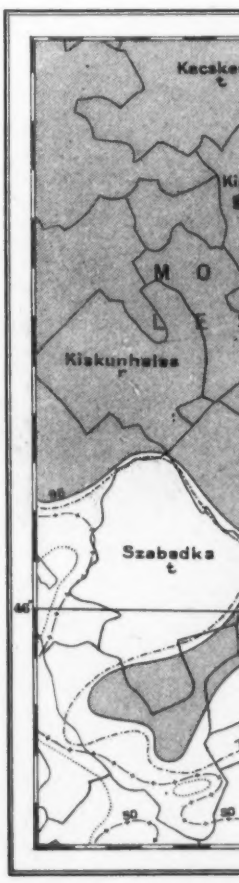
Reference

Per Sq. Mile	Per Sq. Km.
321-384	126-150
257-320	101-125
193-256	76-100
129-192	51-76
64-128	25-50

METHODS OF MAPPING THE DISTRIBUTION OF NATIONALITIES

E





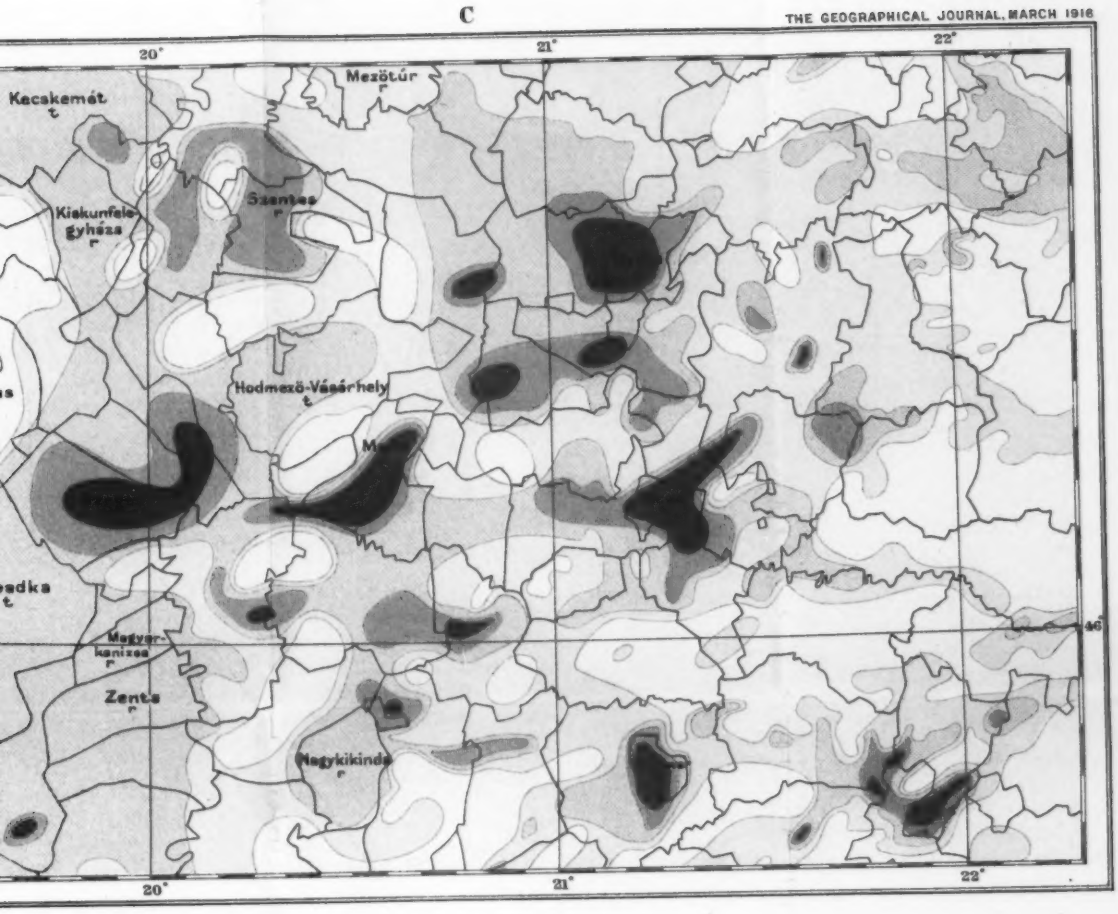
Reference

SLOVAKS	RUMANIANS	SERBIANS
51 - 75%	76 - 95%	51 - 75%
26 - 50%	51 - 75%	26 - 50%
	26 - 50%	

Published by the Royal Geographical Society

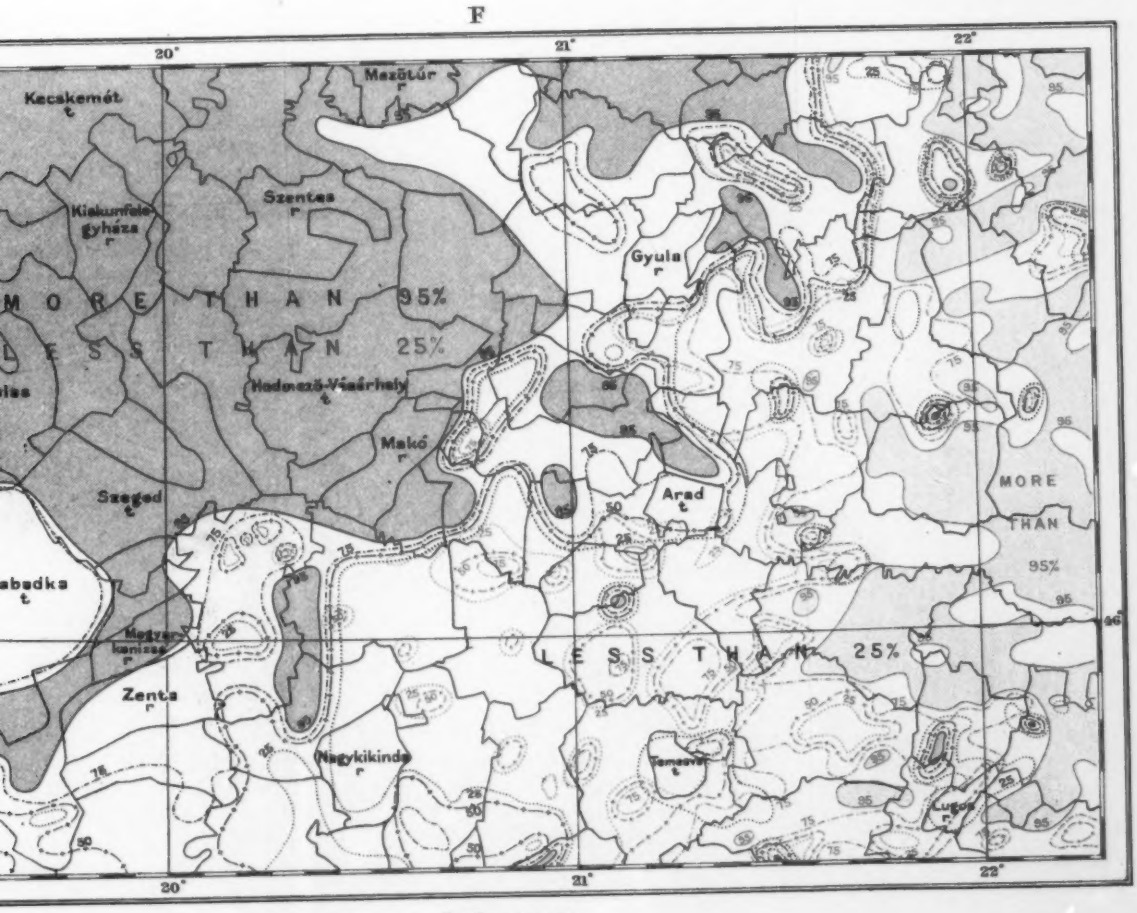
N

C



TIES

F



Reference

= 95% MAGYARS
= 75% "
= 50% "
= 25% "

= 95% RUMANIANS
= 75% "
= 50% "
= 25% "

HUNGARY
Wallis